NewStep™

Motion Control System

User's Manual

Newport®
Experience | Solutions

NewStep Series

Newport
Experience | Solutions

EC Declaration of Conformity

following Annex II-1A
of Directive 2006/42/EC on machinery

The manufacturer:

MICRO-CONTROLE Spectra-Physics,
1 rue Jules Guesde ZI. Bois de l'Epine - BP189
F-91006 Evry FRANCE

Hereby declares that the machinery:

- Description: " NewStep Series "
- Function: NewStep hand-held controller, Motorized Linear Actuator, universal rotator & accessories.
- Models: NSC200; NSA12/V6; NSR-1; NSC200-KT; NSC-485-232-I ; NSC-CB1&3; NSC-JB; NSC-PP; NSC-PS25; NSC-PSC1&3; NSC-SB; USB-232.

– the technical file of which was compiled by:

Mr Dominique DEVIDAL, Quality Director,
MICRO-CONTROLE Spectra-Physics, Zone Industrielle - B.P.29
F-45340 Beaune La Rolande France

– complies with all the relevant provisions of the Directive 2006/42/EC on machinery.
– complies with all the relevant provisions of the Directive 2004/108/EC relating to electro-magnetic compatibility.

– was designed and built in accordance with the following harmonised standards:

- NF EN 61326-1:2006 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
- NF EN 55011:2007 Class A

– was designed and built in accordance with the following other standards:

- NF EN 61000-4-2
- NF EN 61000-4-3
- NF EN 61000-4-4
- NF EN 61000-4-5
- NF EN 61000-4-6
- NF EN 61000-4-11

ORIGINAL DECLARATION

Done in Beaune La Rolande on 10 May 2011
Dominique DEVIDAL
Quality Director

DC1-EN rev:A

Warranty

Newport Corporation warrants that these products will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, products will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport office or representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the products, freight prepaid, to the indicated service facility. Repairs will be made and the products returned freight prepaid. Repaired products are warranted for the remainder of the original warranty period or 90 days, whichever occurs first.

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Newport Corporation
1791 Deere Avenue
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Part No. 90043103, Rev. B

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Service Information

This section contains information regarding factory service for the source. The user should not attempt any maintenance or service of the system or optional equipment beyond the procedures outlined in this manual. Any problem that cannot be resolved should be referred to Newport Corporation.

Technical Support Contacts

North America & Asia

Newport Corporation Service Dept.
1791 Deere Ave.
Irvine, CA 92606, USA
Telephone: (949) 253-1694
Telephone: (800) 222-6440 x31694

Europe

Newport/MICRO-CONTROLE S.A.
Zone Industrielle
45340 Beaune la Rolande, FRANCE
Telephone: (33) 02 38 40 51 56

Newport Corporation USA Calling Procedure

If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a Return Material Authorization Number (RMA#). Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA#, and we will either repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA number. Email: rma.service@newport.com.

When calling Newport Corporation, please provide the Customer Care Representative with the following information:

- Your Contact Information
- Serial number or original order number
- Description of problem (i.e., hardware or software)

To help our Technical Support Representatives diagnose your problem, please note the following conditions:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

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1 Safety Precautions

1.1 Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the NewStep Actuator and Controller where safety-related issues occur.

1.1.1 European Union CE Mark

Figure 1: CE Mark

The CE mark indicates that the equipment has been designed and tested to comply with all applicable European Union (CE) regulations.

1.1.2 Direct Current (DC)

Figure 2: Direct Current Symbol

This symbol indicates that the equipment is suitable for DC power only.

1.2 Warnings and Cautions

The following are definitions of Warnings, Cautions and Notes that may be used in this manual to call your attention to important information regarding your safety, to the safety and preservation of your equipment, and to important tips.

WARNING

Situation has potential to cause bodily harm or death.

CAUTION

Situation has potential to cause damage to property or equipment.

NOTE

Additional information the user or operator should consider.

1.2.1 General Warnings

Observe these general warnings when operating or servicing this equipment:

- Read all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- Only connect the power cord to a grounded power outlet.
- Route power cords and other cables so they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp lint-free cloth.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.

1.2.2 General Cautions

Observe these cautions when operating or servicing this equipment:

- Use only specified replacement parts.
- Follow precautions for static sensitive devices when handling this equipment.
- This product should only be powered as described in this manual.
- There are no user-serviceable parts inside the NewStep system components.
- If this equipment is used in a manner not specified within this manual, the protection provided by the equipment may be impaired.
- Do not position this equipment in a location that would make it difficult to disconnect the AC power cord.

1.3 Manual Conventions

The following conventions are used in this manual:

- **Acronyms** appear on the first occurrence enclosed in parentheses following their definition. An acronym is a word formed from the initial letters of a string of words. Example: Read Only Memory (ROM).
- **Italics or boldface text** are used as an alternative to quotation marks to highlight special text, such as keyboard keys, onscreen buttons, or text entries. Examples: Press *Enter*. **AU** command.

2 Features & Specifications

2.1 NewStep™ System Overview

Newport's NewStep family of motion controllers and positioners are designed to provide affordable, motorized fine-positioning of mechanical stages and optical mounts in a wide range of optomechanical systems. NewStep system components (as of December 2010) include the following:

MODEL	DESCRIPTION
NSC200	Hand-held motion controller/driver with manual controls and an addressable RS485 computer interface.
NSA12	Miniature linear motorized actuator, 11 mm travel.
MFA-PP	Motorized linear Stage, 25 mm travel.
NSC-PS25	AC power supply.
NSC-PSC1	1 meter (3 ft) power supply output cable.
NSC-PSC3	3 meter (10 ft) power supply output cable.
NSC-485-232-I	RS485-to-RS232 converter.
NSC-JB	Junction box to split 1 RS485 channel into to 5 channels.
NSC-CB1	1 meter (3 ft) RS485 cable.
NSC-CB3	3 meter (10 ft) RS485 cable.

NSC200-KT	NewStep kit including NSC200 controller, NSA12 actuator, NSC-PC25 power supply, NSC-PSC3 power supply cable.
NSC-INT-KT	Computer Interface Kit including NSC-CB1, NSC-CB3, NSC-485-232-I, USB-232 and NSC-JB
NSC-SB	Switchbox allowing one NSC200 to drive up to 8 positioners, including the cables: **P/N NSC-PSC3** 3 m (10 ft) power cable to controller. **P/N 15769-02** 1.8 m (6 ft) driver cable to controller. **P/N NSC-CB2** 1.8 m (6 ft) RS485 cable to controller.

2.2 NSC200 Controller / Driver

The NSC200 is an integrated, single-axis, stepper motor controller/driver. It is designed to be hand held but also provides through-holes for bolting to an optical table with a 1" or 25 mm grid of mounting holes. Used by itself, the NSC200 provides easy and affordable means to control a single positioner, which can be an NSA12 linear actuator or MFA-PP linear stage. Ultra-smooth, high-resolution positioning is provided by 64x micro-stepping and all-digital control, which provides increased accuracy and reliability compared to potentiometer based designs.

Use of an external **NSC-SB switchbox** allows a single NSC200 to control up to eight positioners one channel at time.

Two primary control modes are selectable whether or not a switchbox is used: **Local** (manual control) or **Remote** (computer control). Selection of Local or Remote is by pressing the knob of the NSC200. The control mode is indicated by the color of a tri-color LED. Remote is the default mode at power-up. For details on Local operation, see Section 4 of this manual.

Two secondary control modes are selectable whether the controller is in Local or Remote mode: **Velocity** or **Position.** Velocity is the default mode at power-up.

In Velocity mode, the rotary knob at the front of the NSC200 is turned to select one of eight (8) speed settings for each direction plus a rest position. Rotate the

knob in one direction, and the positioner moves in that direction. Rotate the knob in the other direction, and the actuator moves in that other direction. The farther the knob is rotated, the faster the positioner moves. The knob is spring-loaded and returns to its zero point when released, thus stopping motion.

In Position mode, the rotary knob is turned to its extreme clockwise or counter-clockwise position. The controller then moves the positioner by a preset number of micro-steps, either up or down.

Remote (computer) control makes use of the NSC200's digitally addressable RS485 port, which is interfaced to the RS232 COM port of a PC. The interface is provided by an RS485-to-RS232 converter, an optional 1x5 RS485 junction box, plus cables, all available from Newport. In Remote mode, the NSC200 accepts and executes ASCII commands. These can be issued in three primary ways:

NewStep-Util software, distributed on CD with each NSC200. For details, see Section 5 of this manual.

User-written LabView applications using drivers distributed on CD with each NSC200. The drivers are compatible with *LabView 6*, *7* or *8*.

Other user-written software that issues and receives ASCII commands, as documented in Section 6 of this manual. For details, see Section 5 of this manual.

Compared to the predecessor NSC100, the NSC200 offers a number of new features and higher communication speeds. As a result, the versions of *NewStep-Util* software, LabView drivers, and ASCII command set developed for the NSC200 are not backward compatible with the NSC100. It is however possible to use NSC100's and NSC200's on the same RS485 network provided that their respective software is used.

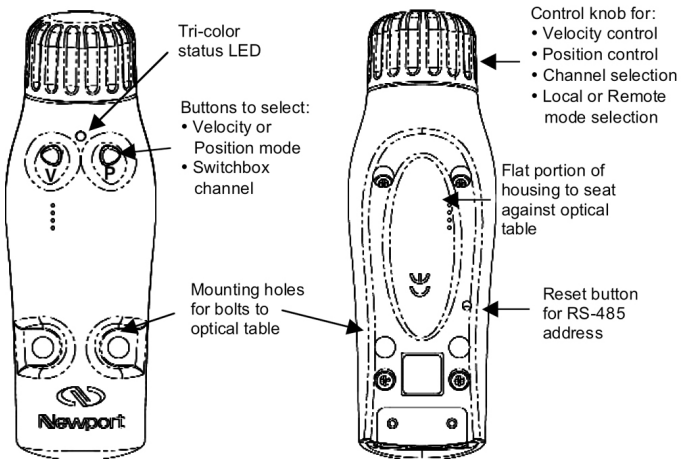

Tri-color status LED
Buttons to select:
• Velocity or Position mode
• Switchbox channel
Mounting holes for bolts to optical table
Newport
Control knob for:
• Velocity control
• Position control
• Channel selection
• Local or Remote mode selection
Flat portion of housing to seat against optical table
Reset button for RS-485 address

Figure 3: NSC200 top and bottom views

Specifications

Number of controlled axes	1 without NSC-SB switchbox 8 with NSC-SB switchbox
Operating modes	1. Manual velocity mode. 2. Manual position mode. 3. Computer controlled mode.
Selection of manual or computer	Pressing down on control knob.
Controls, Local (manual) mode	1. Button to select velocity mode. 2. Button to select position mode. 3. Rotary knob to activate motion.
Controls, Remote (computer) mode	ASCII commands I/O via RS485 port.
Power requirements When driving positioner In standby mode	 0.7A @ 15 Vdc 0.3A @ 15 Vdc
Power output when driving positioner	400 mA @ 15 Vdc
Compatible positioners	NSA12 linear actuator. MFA-PP motorized linear stage.
Stepper motor control	64 micro-steps per full-step.

Connectors	Coaxial mini jack for power input 6-position, 4-wire RJ11 jack for RS485 9-pin mini DIN, female, to positioner
Mechanical Dimensions (W x D x H) Weight	 50 x 150 x 50 mm (2” x 6” x 2”) 250 g (9 oz)
Environmental	See NewStep system specs

2.3 NSC-SB Switchbox

Figure 4: NSC-SB Switchbox, Front and Side

The NSC-SB switchbox is a intelligent multiplexer (or switch) which allows one NSC200 controller to drive up to eight NewStep positioners one channel at a time. The controller mode can be either Local or Remote. In Local mode, the channel is selected by first simultaneously pressing the **V** and **P** buttons for five seconds, then pressing the **V** and **P** buttons individually to increment or decrement the channel. In Remote mode, the channel is selected under computer control. In either mode, the status of each channel is indicated by the color of a bank of tri-color LEDs labeled 1-8.

When used, switchbox serves as the connection hub between the power supply, computer (if applicable), and positioners. The controller detects the presence of the switchbox and automatically enables or disables functionalities as required.

- **Power.** The side of the switchbox features two coaxial mini jacks, one labeled with a symbol for power in, one labeled *Controller*.

- **RS485 I/O.** In Remote mode, the switchbox communicates with the computer via a first RS485 cable, and in turn communicates with the controller via a second RS485 cable. The side of the switchbox features two RJ11 jacks, one labeled *PC*, one labeled *Controller*. In Local mode, only the RS485 cable to the controller is used.
- **Drive Signals.** The switchbox can drive up to eight NewStep positioners, and in turn is driven by the controller. The back of the switchbox features eight female 9-pin mini-DIN connectors for positioner cables. The side of the switchbox features a single female 9-pin mini-DIN connector for connection to the controller.

Specifications

Positioner input channels	1 (multiplexed by switchbox)
Positioner output channels	8 (only selected channel is active)
Power requirements	15 Vdc, 40 mA
Channel status indication	One tri-color LED per channel
Case dimensions (H x W x D)	35 x 182 x 151 mm (1.4” x 7.2” x 5.9”)
Case material	Aluminum, painted.
Connector for power input	Coaxial mini jack, positive center.
Connector to computer (if used)	6-position, 4-wire RJ11 for RS485 I/O.
Connectors to positioners	8 connectors, 9-pin mini-DIN, female.
Connectors to controller	6-position, 4-wire RJ11 for RS485 I/O. Coaxial mini jack, positive center, for power. 9-pin mini-DIN, female, for drive signal.
Cables to controller	**P/N NSC-PSC3** 3 m (10 ft) power cable. **P/N 15769-02** 1.8 m (6 ft) driver cable. **P/N NSC-CB2** 1.8 m (6 ft) RS485 cable.

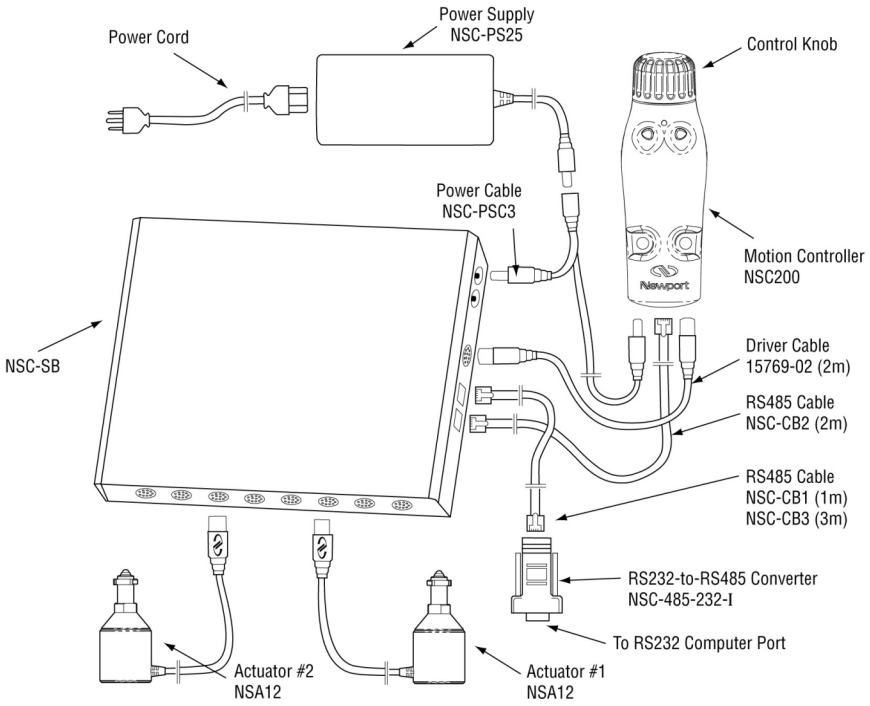


Figure 5: Switchbox Connections

2.4 NSA12 Linear Actuator

Designed as micrometer replacement, the NSA12 linear actuator is ideal for remote adjustment of sensitive, hard-to-reach optical mounts, which could be influenced by the forces imposed by manual adjustment of micrometers. Typical applications include optimizing the alignment of a laser cavity, zeroing in on coherence lengths, or just adjusting the pointing of a beam over a long distance.

The NSA12 provides a motorized, linear plunger, whose position can be controlled with sub-micron resolution over 11 mm of travel. The plunger can drive a load up to 28 N and is terminated by a non-rotating 5/32” chrome-vanadium steel ball bearing. The drive mechanism incorporates a spring mechanism that virtually eliminates backlash.

The NSA12 is easily mounted via its .375” x 40 pitch threaded shaft. This mechanical interface is compatible with many Newport mounts and manual stages. A mounting nut and wrench are included.

The NSA12 can be driven by an NSC200 controller either directly or via one of the eight output ports of an NSC-SB switchbox.

Figure 6: NSA12 Linear Actuator

Figure 7: Mounted NSA12

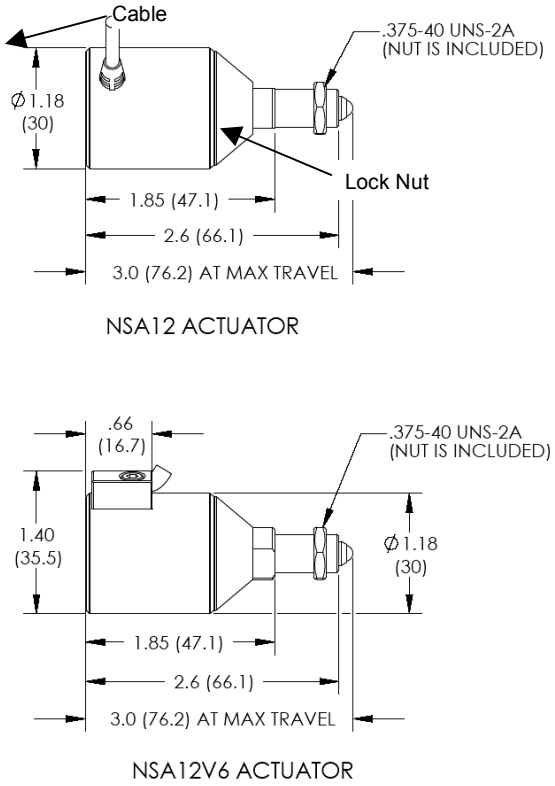


Figure 8: Dimensions, NSA12 Linear Actuator

Specifications

Diameter	30 mm diameter
Length	66.1 mm retracted, 76.2 mm extended
Provision for mounting	.375-40 UNS-2A threads, nut included.
Actuating element	Plunger with non-rotating 5/32” ball tip.
Limit switch	Optical limit switch on motor side
Travel range	11 mm
Motor	2-phase stepper motor, open loop

Drive mechanism	Direct drive, non-rotating lead screw
Drive screw pitch	0.3048 mm/revolution
Full-step	6.4 µm (48 full-steps/revolution)
Micro-step (1/64 of full-step)	0.10 µm (1/64 of full-step)
Minimum incremental motion	0.30 µm (3 micro-steps)
Unidirectional repeatability	2.2 µm
Bidirectional repeatability	< 10 µm
Load capacity	28 N (2.9 kg-force or 6.3 lb-force)
Max speed, no load	1.0 mm/sec
Weight	0.1 kg (0.2 lb)
Length of drive cable	3 m (10 ft)
Cable connector	9-pin mini DIN, male
Vacuum compatibility	10^{-6} Torr (Model NSA12V6)
Housing finish	Black anodized aluminum (NSA12) Natural aluminum (NSA12V6)
Environmental	See NewStep system specs

2.5 MFA-PP Motorized Linear Stage

The MFA-PP motorized linear stage is an economical solution for space-limited applications which require very high resolution, single-axis translation of up to 25 mm. Two stages can be stacked for two-axis XY, XZ or YZ control. Three stages can be stacked for three-axis XYZ control, as shown in photo below.

MFA stages feature an all-steel construction that provides a higher stiffness-to-weight ratio with lower thermal expansion than aluminum designs. The result is superior performance in a smaller footprint. The smooth motion of MFA stages is achieved by Newport's proprietary double-row linear ball bearing design with bearing ways that are directly machined into the structural elements of the stage. Compared to alternative solutions that use commercial bearings, MFA linear stages offer a higher load capacity and stiffness with low pitch and yaw errors. End-of-run limit switches prevent bearing damage from accidental over-travel.

Installation of an MFA stage on an optical table requires a Model MFA-BP base plate. Optical components can be secured directly to the top surface of the moving stage, which is small but provides 4 mounting holes with M2 threads plus 6 mounting holes with M3 threads. Greater flexibility in mounting optical

components is provided by an add-on top plate. This is normally an MFA-TP plate with Imperial threads or an M-MFA-TP plate with metric threads.

Two stages can be stacked directly for XY control. Stacking of stages for XZ, YZ or XYZ control (with a vertically mounted stage) requires use of a single MFA-BK top plate. This plate provides through-holes for tapped mounting holes at the end of the fixed frame of the stage. Note that top and bottom mounting plates are not included with the MFA stage, but must be ordered separately.

An MFA-PP stage can be driven by an NSC200 controller either directly or via one of the eight output ports of an NSC-SB switchbox.

CAUTION

MFA stages contain delicate, factory-preloaded parts. Only operate in a clean environment. Avoid mechanical shock. Never attempt to disassemble the stage. Any unauthorized disassembly will void the warranty. We recommend that you return the stage to the factory after every 2000 hours of use for lubrication and readjustment.

Figure 9: Single MFA-PP Linear Stage

Figure 10: Stacked MFA-PP Linear Stages

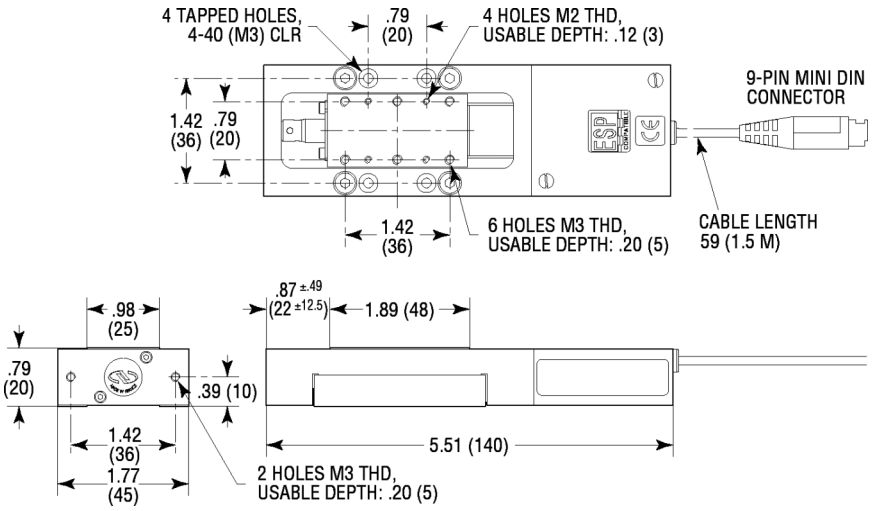


Figure 11: Dimensions, MFA-PP Motorized Linear Stage

	DIMENSIONS [in. (mm)]		THREAD	
	A	B	C	D
MFA-TP	1.00 (25.4)	2.00 (50.8)	4-40	8-32
M-MFA-TP	.98 (25.0)	1.97 (50.0)	M3	M4

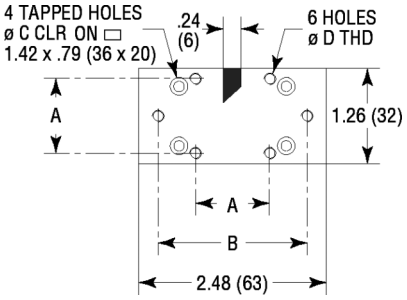
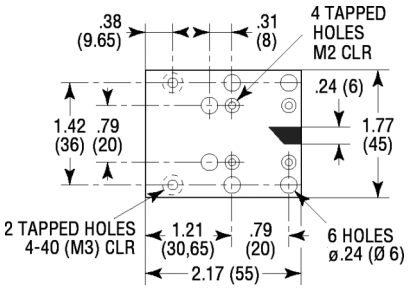


Figure 12: MFA-TP Top Plates



Top plate used to stack MFA-PP for Z-axis control.

Figure 13: MFA-BK Top Plate

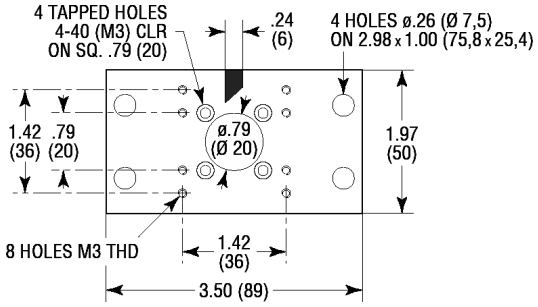


Figure 14: MFA-BP Base Plate

Specifications

Size (H x W x L)	20 x 45 x 140 mm (.79" x 1.77" x 5.51")
Weight	0.6 kg (1.5 lb)
Provision for mounting	Add-on top and bottom mounting plates
Base material	Stainless steel
Bearings	Double row linear ball bearings
Drive mechanism	Backlash compensated lead screw
Motor	2-phase stepper motor
Drive screw pitch	0.5 mm
Reduction gear	1:43
Limit switches	One mechanical switch per direction
Travel Range	25 mm
Full-step	0.485 µm
Micro-step	0.00757 µm (1/64 of full-step)
Minimum Incremental motion	0.1 µm
Unidirectional repeatability	0.5 µm
Bidirectional repeatability	2.5 µm
Home position repeatability	4 µm
On-axis accuracy	8 µm
Load capacity, vertical	50 N
Load capacity, along axis	10 N
Max speed, no load	0.3 mm/sec
Torsional stiffness, pitch	60 µrad/Nm
Torsional stiffness, roll	100 µrad/Nm

Length of drive cable	1.5 m (5 ft)
Cable connector	9-pin mini DIN, male
Environmental	See NewStep system specs

2.6 NSR

Figure 15: NSR

The NSR-1 is an economical and versatile rotary positioner for use as a filter wheel, a neutral density rotator, polarized optic rotator, flipper mount or basic rotation platform. It features a 1" threaded aperture, retaining ring and internal reference surface for 25.4 mm optics, a 1-degree step resolution, and up to 30 °/s speed. The NSR-1 serves as a base unit, and can be used as a rotator for 25.4 mm optics. For optimum performance and seamless compatibility, the NSR-1 has been designed to operate with the NSC200 motion controller

Accessories are also available, including a filter wheel (NSFW-1) for up to 8 - 25.4 mm optics, a 127 mm diameter variable ND filter adapter (NSND), a tooling plate (NSTP-1) featuring an array of tapped holes, and a unique set of

adapters to transform the rotator into a motorized flipper mount (NSFM-1). Refer to the NSR-1 Quick Start Guide for more details. Combined with the new NSC200 controller, the NSR1 takes the place of up to 5 separate devices at one fifth of the price.

The NSR-1 can be driven by an NSC200 controller either directly or via one of the eight output ports of an NSC-SB switchbox

Design Details

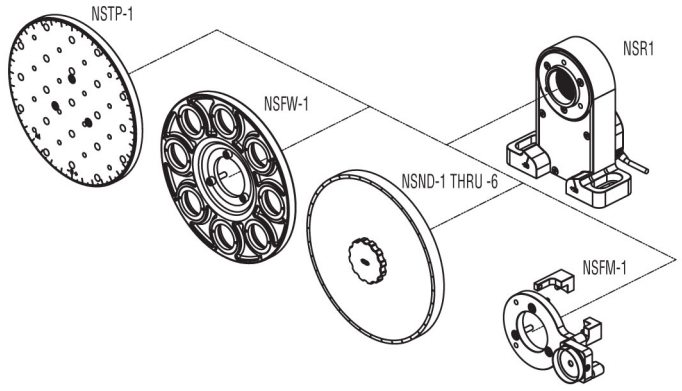


Figure 16: NSR Dimensions

Base Material	Aluminum
Bearings	Ball Bearings
Drive Mechanism	Belt
Feedback	NSR Series
Home Switch	Magnetic Home Switch. Homing Repeatability Is <0.15°*
Motor	NSR Series
Cable Length (m)	3
Weight [lb (kg)]	0.9 (.4)

Time to complete homing sequence is <25sec.

Specifications

Travel Range	360° continuous[1]
Resolution	1°
Uni-directional Repeatability	0.25°
Reversal Value (Hysteresis)	<2°
Maximum Speed	120°/s
Minimum Incremental Motion	1°
Wobble (µrad)	<600
Maximum Torque	0.06Nm

[1] **Note: When the NSR-1 is used with the NSFM-1 in the flipper mount configuration the travel range is 90° and 180°**

NSR-1 with NSFW-1 Specifications

- Holds 8 - 1” Filters 0.15" thick
- Includes reference surface for mounted filters and standard A-1/25-1RR retaining ring
- Filter to Filter switching of <0.5 seconds
- Direct Drive allows both manual and motorized indexing of wheel.

NSR-1 with NSFM-1 Specifications

- Includes U50-P1 + UPA1 mounts. Larger mounts may also be attached when proper counterweighted
- Hard stops equipped with magnets to assure repeatable motions
- Hard stops can be positioned at 9, 12 or 3 o’clock to provide 90 to 180 deg travel

NSR-1 with NSND-1 Specifications

- Includes Newport 50G or 50Q series ND filters
- Direct Drive allows both manual and motorized indexing of wheel
- Large usable area

NSR-1 with NSTP-1 Specifications

- Plate includes both Metric (M4) and Imperial 1⁄4”-20 tapped through holes
- Index marks on perimeter for user reference
- Adapter bracket provided with NSR1 base unit allows horizontal mounting

NSR-1

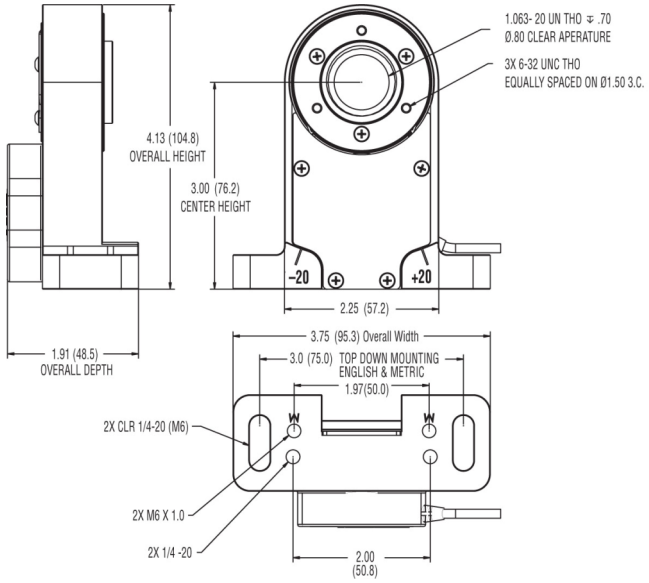


Figure 17: NSR Design Details

2.7 NSC-PS25 Power Supply

The NSC-PS25 is a switching power supply designed to drive one or multiple NSC200 NewStep controllers either directly or through an NSC-SB switchbox. Input power can be 90-246 Vac, 47-63 Hz. Output power is 15 Vdc, 4.6A max.

A single NSC-PS25 power supply can drive multiple NSC200 controllers, which consume 0.7A while driving a positioner and 0.3A in standby mode. Power consumption is not materially affected by driving a positioner through a switchbox. To determine the maximum number of NSC200 controllers that can be connected to a single power supply, add the current draw of all controllers that will be driving loads simultaneously to that of all controllers in standby mode.

It is theoretically possible for a single computer COM port to command up to 32 controllers by daisy chaining multiple NSC-JB 1x5 RS485 junction boxes, and all controllers could be driving loads simultaneously. In that case, current draw considerations would limit the maximum number of controllers to 4.6A / (0.7A/controller) = 6 controllers. When driving multiple positioners through an NSC-SB switchbox, only one of the positioners is driven at a time by the controller.

The NSC-PS25 comes with a 3 m (10 ft) DC power output cable, which is terminated by a coaxial DC power output connector with a 5.5 mm outer ground and a 2.5 mm positive center. This connector can be plugged directly into the power jack of an NSC200 controller or NSC-PSC3, which will then in turn power the controller. The connector can also be plugged into a power cable which branches power to two (2) DC power output connectors. By daisy chaining branching power cables, it is possible to power multiple controllers or switchboxes from the same supply.

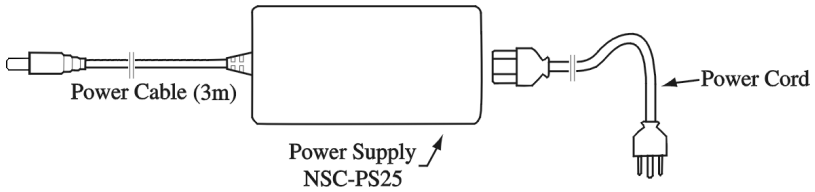


Figure 18: NSC-PS25 Power Supply to One load

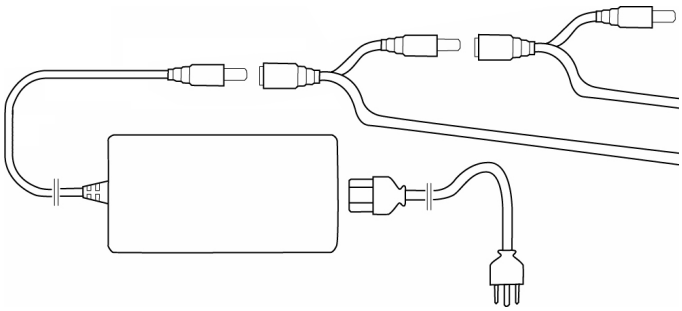


Figure 19: NSC-PS25 Power Supply to Multiple Loads

Specifications

Input voltage	90-246 Vac
Input current, max	1.5A
Output voltage, nominal	15 Vdc
Output current, max	4.6A
Supply efficiency	85% (switching type)
Case size (H x W x L)	30 x 58 x 132 mm (1. 2" x 2.3" x 5.2")
Length of DC power output cord	3 m (10 ft)
DC power output connector	Coaxial, 5.5 mm outer ground, 2.5 mm positive center.
DC power output branching cables (optional) NSC-PSC1 NSC-PSC3	 1 m, two DC power output connectors 3 m, two DC power output connectors
Environmental	See NewStep system specs

2.8 NSC-JB RS485 Junction Box

The NSC-JB is a passive junction box which allows a single 6-position, 4-wire RJ11 jack to be branched into up to five jacks. By using a single NSC-JB, a single NSC-485-232-I converter connected to a computer COM port can command up to five digitally addressable NSC200 controllers. NSC-JB junction boxes can also be daisy chained to increase the number controllers. The theoretical maximum number of controllers connected to a single RS-485 line is 32 for current drain reasons, as specified by the RS485 standard.

Physically, the NSC-JB consists of a white plastic case with five RJ11 jacks, plus a 3.6 m (12-foot) cable terminated by an RJ11 plug. Two mounting ears are provided. All like pins are wired in parallel, with no active components.

Figure 20: NSC-JB RS485 Junction Box

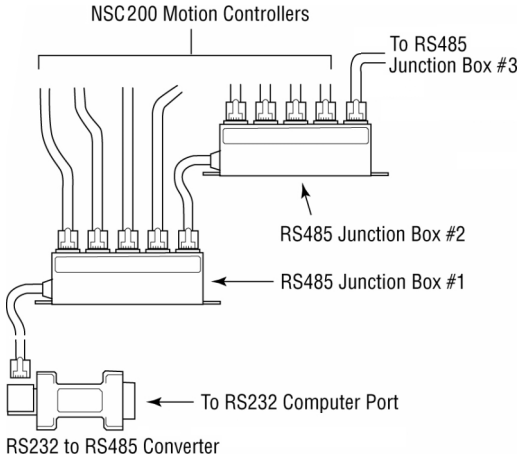


Figure 21: Branching with Multiple RS485 Junction Boxes

Specifications

Input connector (computer side)	6-position, 4-wire RJ11 plug
Output connectors (controller side)	Five 6-position, 4-wire RJ11 jacks
Signal processing	None. Device is passive.
Environmental	See NewStep system specs

2.9 NSC-485-232-I RS485-to-RS232 Converter

The NSC-485-232-I is a line-powered, half-duplex, RS485-to-RS232 converter, which allows the RS232 COM port of a computer to command one or multiple NSC200 controllers via a single RS485 line. A 6-position, 4-wire RJ11 jack is on the controller side. A female DB9 connector is on the computer side.

Normally the converter is plugged directly into the computer and is secured to the computer with two connector screws. As an alternative, the converter can be attached to the computer by means of a straight-through serial data cable (readily available in computer stores) with a male DB9 connector on one end and a female DB9 connector on the other end.

Figure 22: NSC-485-232-I Converter

Specifications

Input connector (RS232 side)	DB9 connector, female
Output connector (RS485 side)	6-position, 4-wire RJ11 jack
Power source	RS232 handshake lines
Dimensions (H x W x L)	23 x 33 x 76 mm (0.9” x 1.3” x 3.0”)
Environmental	See NewStep system specs

2.10 NewStep™ System Environmental Specifications

CAUTION

The NewStep NSC200 motion controller and positioners are high-precision laboratory instruments. Only use and store in a clean

	laboratory environment. Avoid mechanical shock to positioners.

Max operating temperature	5°C to 40°C
Recommended operating temperature	20°C to 25°
Operating relative humidity	< 85%, non-condensing
Storage temperature	0-60°C
Storage relative humidity	< 85%, non-condensing
Altitude	< 2000 m (6,562 feet)
Installation category	II
Pollution degree	2
Use location	Indoor use only

3 Getting Started

3.1 Unpacking and Handling

It is recommended that NewStep NSC200 motion controllers and other system components be unpacked in your lab or worksite, rather than at the receiving dock. Unpack the system carefully, as small parts and cables are included. Inspect the box carefully for loose parts before disposing of the packaging. Save the packaging material in case you ever need to ship your equipment.

3.2 Inspection for Damage

The NewStep system components have been carefully packaged at the factory to minimize the possibility of damage during shipping. Inspect the box for external signs of damage or mishandling, and inspect the contents for damage. If there is visible damage to the equipment upon receipt, inform the shipping company and Newport Corporation immediately.

WARNING

Do not attempt to operate this equipment if there is evidence of shipping damage or if you suspect shipping damage. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.

3.3 Inventory of Parts

Verify that you have received all of the NewStep system components that that you have ordered. Refer to the connection diagrams in this manual to verify that you have ordered and received all of the components that you will be needing.

The following is a list of parts included with the NewStep Actuator and Motion Controller Kit, Model NSC200-KT:

1. NSC200 NewStep Motion Controller
2. NSA12 NewStep Actuator
3. NSC-PS25 Power Supply with AC Power Cord
4. NSC-PSC3 DC Power Cable, 3 Meter
5. User's Manual

If you are missing any hardware, have questions about the hardware that you have received, or need to order additional hardware, please contact Newport.

3.4 Installation Location

Your NewStep system is designed for operation in a laboratory environment. The recommended ambient operating temperature is between 20°C and 25°C. Operation at slightly higher or lower ambient temperatures for limited periods (e.g., several hours) will not cause harm, but may reduce performance.

An optical table with a steel surface and threaded mounting holes on a 1" or 25 mm grid is recommended to secure optical components. The NSC200 controller and MFA-PP motorized linear stage are designed to be mounted on such a grid; however, a NewStep system may be placed on any reasonably firm table or bench for operation.

The NewStep power supply, Model NSC-PS25, is a switching supply and is auto-sensing for 100-240 Vac, 50/60 Hz, AC power. Have a qualified electrician verify that the wall socket you will be using is properly polarized and grounded.

3.5 Interconnecting NewStep Components

NewStep systems can range from simple to complex. A simple system may consist of one NSC200 controller, one NSA12 actuator and one NSC-PS25 power supply. Complex systems may include the NSC-SB switchbox and multiple NSC200 controllers powered by the same supply and commanded by the same computer via RS485.

The following are some key points of understanding for the more complex NewStep systems:

Power Branching. The NSC-PS25 power supply comes with a DC power output cord, which can be plugged into an NSC200 controller or NSC-PSC3. Multiple controllers or switchboxes can be powered by the same supply by daisy-chaining branching power cords. A single supply can power up to 6 controllers that are simultaneously driving positioners.

RS485 Branching. When an NSC-JB RS485 junction box is used, up to five NSC200 controllers or NSC-SB switchboxes can be connected to the same RS485 line and be addressed digitally from the same computer COM port. Junction boxes can be daisy chained. For computer control, an NSC-485-232-I converter is always required to convert the RS232 signal of the computer to the RS485 signal of the NewStep system. This converter is normally attached to the computer COM port. When a switchbox is used with computer control, the switchbox is connected via a first RS485 cable to the converter and via a second RS485 cable to the associated controller. When a switchbox is used without a computer, there still has to be an RS485 cable between the switchbox and controller so that these can exchange data.

An NSC-SB switchbox always acts as a connection hub between the associated controller, positioners, and computer (if applicable). The switchbox can only drive one positioner at a time under control of a single controller, and it does not materially add to power consumption. There always has to be a set of three cables between the switchbox and its associated controller:

a) Positioner driver cable: 1.8 meter (6 ft) cable with two male mini-DIN connectors, P/N 15769-02.

b) RS485 data cable: 1.8 m (6 ft) cable with two 6-position, 4-wire RJ11 connectors, P/N 15769-02.

c) DC power supply cable: 3 m (10 ft) extension cable with a male coax power connector on one end female coax connector on other end, P/N NSC-PSC3.

Please refer to the illustrations below for examples of connected systems. Only apply power after you have interconnected all system components and have studied the next chapter of this manual entitled “Operating NewStep.”

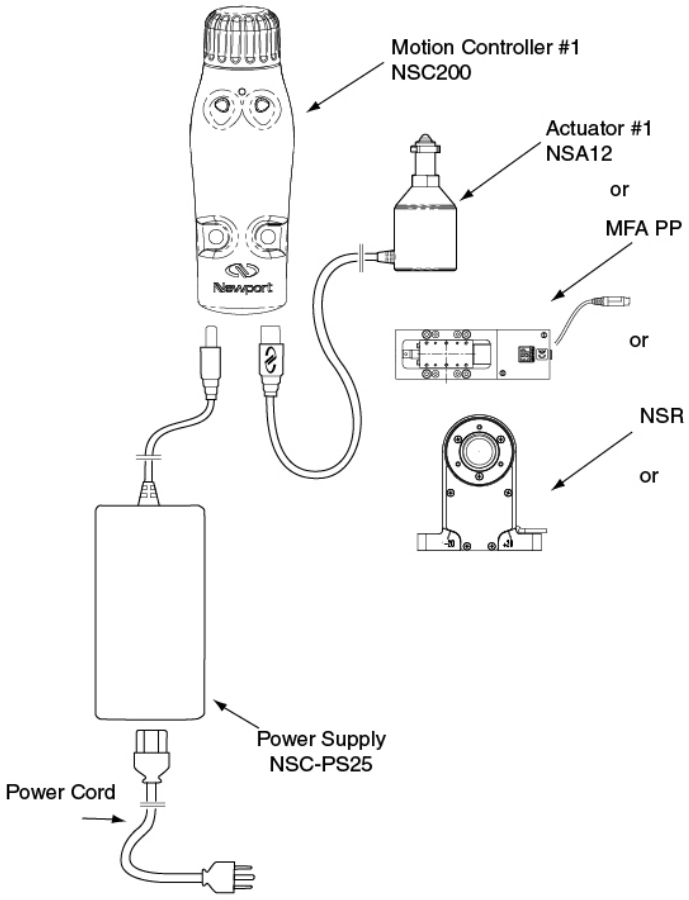


Figure 23: Connections, 1 Controller, 1 Supply

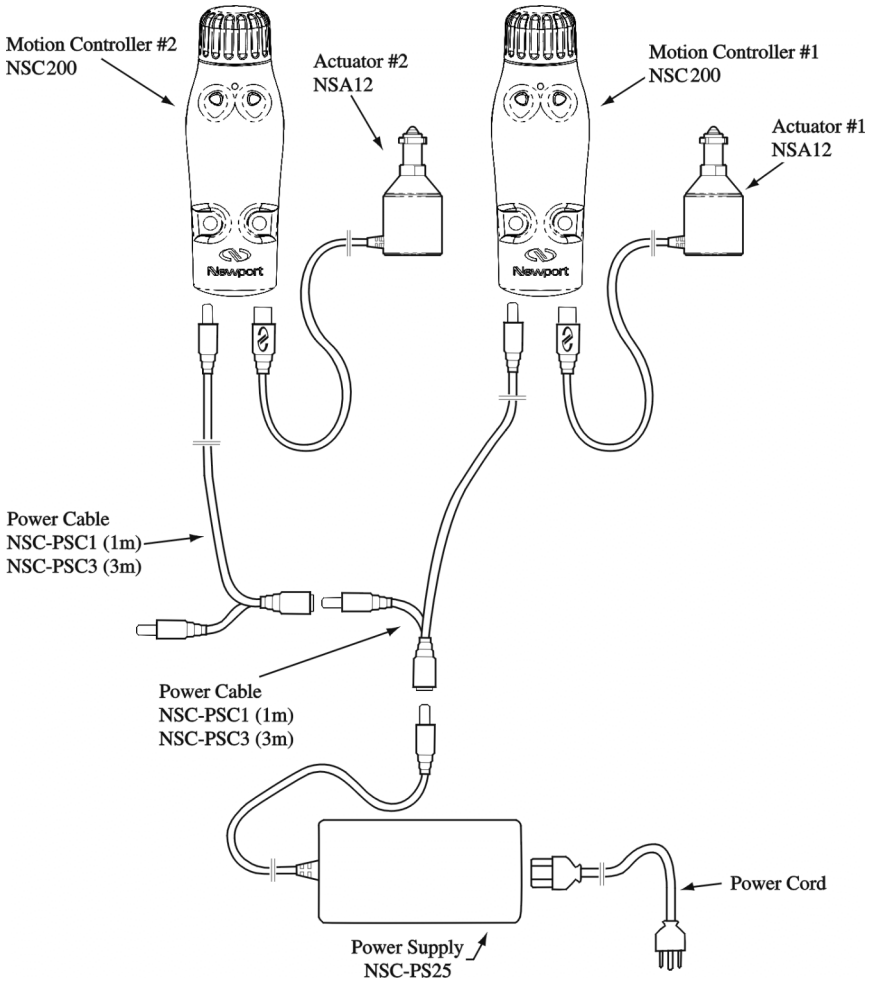


Figure 24: Connections, 2 Controllers, 1 Supply

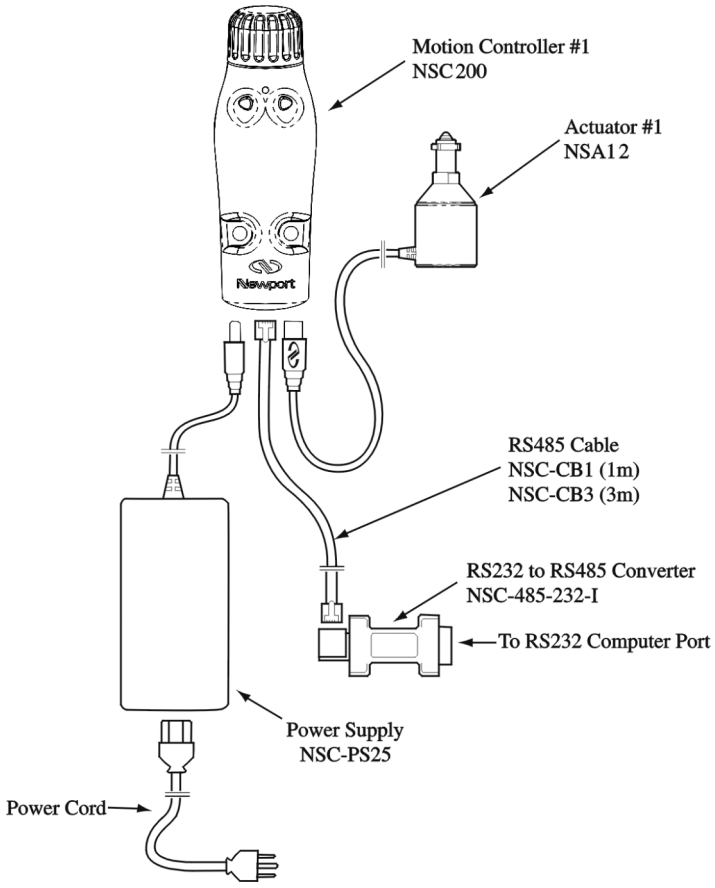


Figure 25: Connections, 1 Controller, 1 Supply, Computer Control

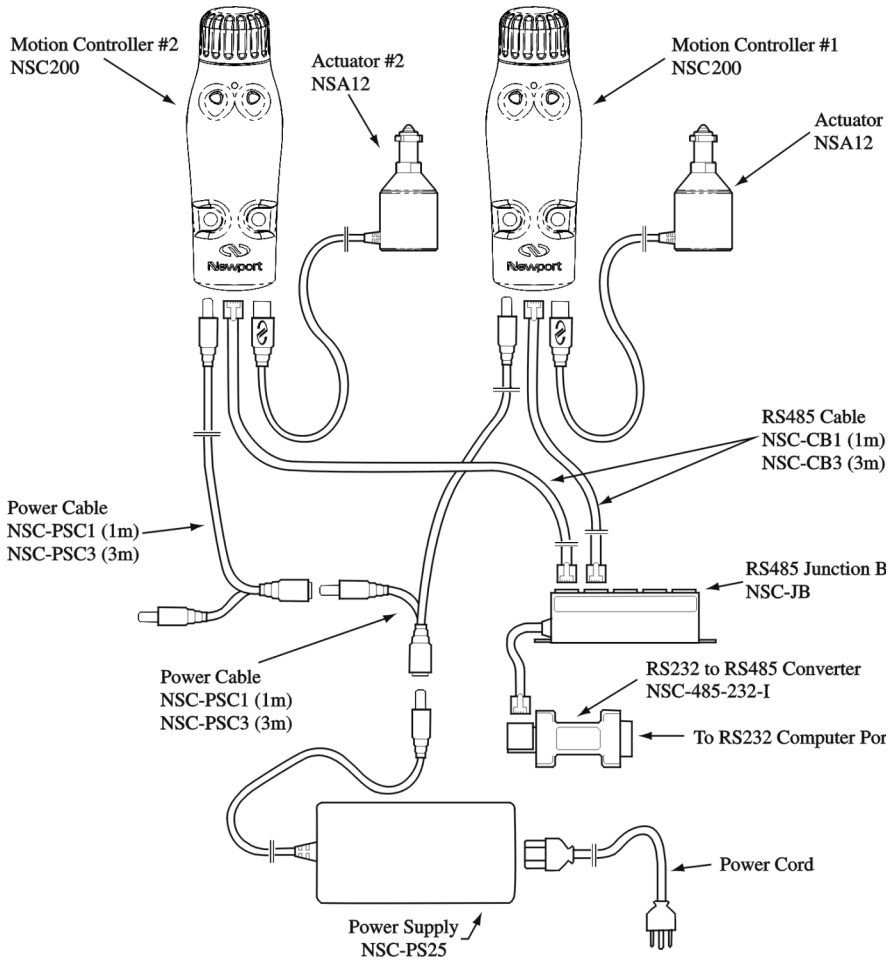


Figure 26: Connections, 2 Controllers, 1 Supply, Computer Control

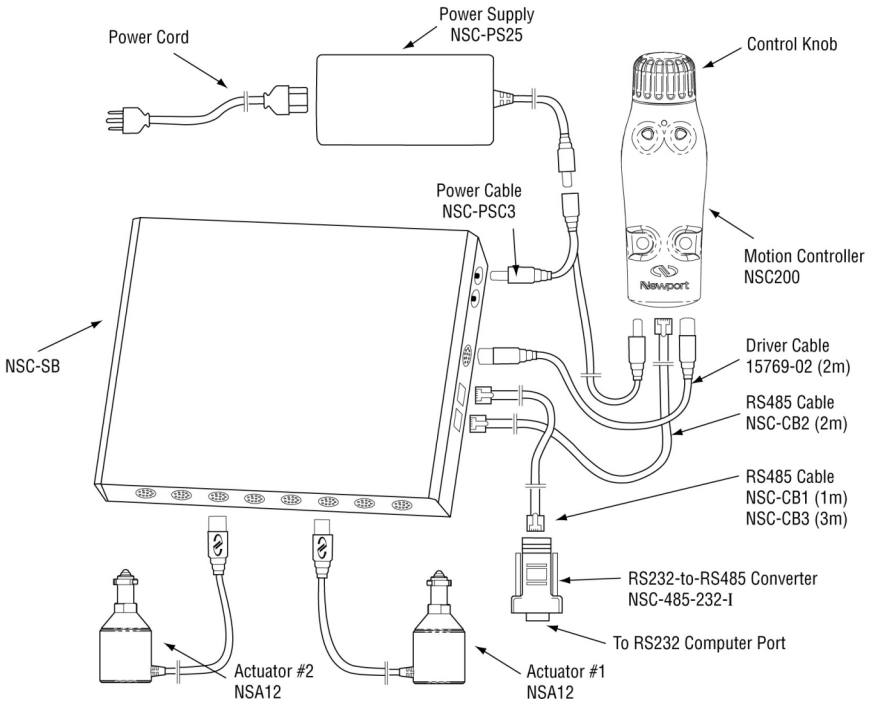


Figure 27: Connections, 1 Controller, 1 Switchbox, 2 Positioners

3.6 Connection to Non-NewStep Components

The NewStep system is primarily intended as a closed system which only utilizes the components described in this manual.

Other controllers. Use of a non-NewStep controller with NewStep positioners is strongly discouraged. This is because the NSA12 linear actuator and MFA-PP linear stage provide only one limit signal, and the current and duty cycle must be strictly controlled to avoid damage.

CAUTION

There is a high risk of damage to a NewStep positioner with use of a non-NewStep controller. Such use immediately voids the warranty of the positioner.

Other positioners. Use of non-NewStep positioners with a NewStep controller is possible for customers with experience in stepper motor control systems engineering. Newport is not equipped to provide personal support for such applications, but can provide technical information in the form of a Technical Application Note:

DS-111001. Using NSC200 with Non-NSA12 Actuators

DS-04041. Using a NSA 12 with a controller other than the Newport NSC200.

CAUTION

Newport can only guarantee CE compliance of NewStep components when these are used with other NewStep components, including cables.

4 Local Operation

4.1 Operating Modes

The NSC200 NewStep controller has two primary operating modes: **Local** and **Remote**.

The controller also has two secondary operating modes: **Velocity** and **Position**. These can be selected by pressing buttons marked **V** or **P** or the body of the controller, or via software commands. The default mode at power-up is Velocity.

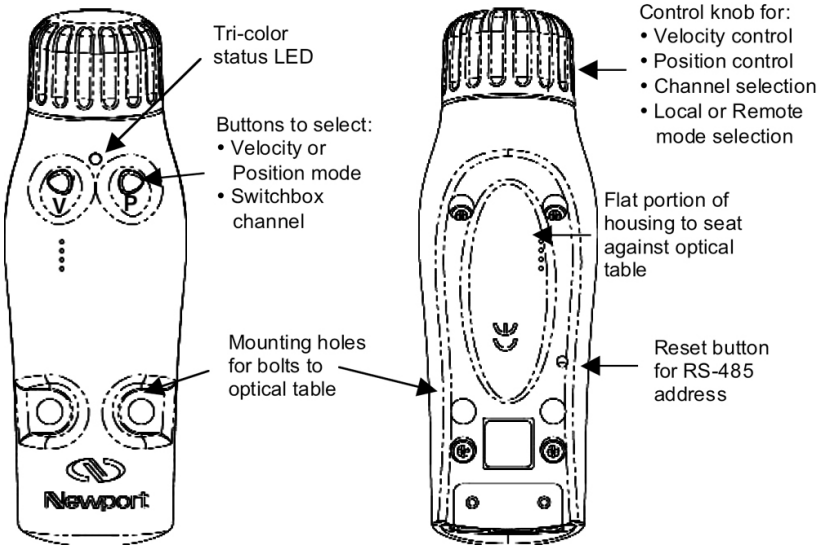


Figure 28: NSC200 top and bottom views

4.2 Manual User Controls

Selection of Remote or Local mode. Press in the control knob to toggle between Local and Remote. The new selection will only become effective after any ongoing motion has stopped. In Remote mode (yellow LED), the controller responds to computer commands only, and the control knob is disabled. In Local mode (green LED), the control knob is enabled, and computer commands are disabled.

Selection of Velocity or Position mode. First press the control knob to switch from Local to Remote (yellow LED). Then press the left button (marked **V**) for Velocity or right button (marked **P**) for Position. Hold down the button for 2 seconds. The LED will flash twice to indicate that the mode was successfully changed. Following the mode change, press the control knob again to switch back to Local (green LED).

Homing the positioner. Press down the control knob for longer than 5 sec. The currently selected positioner will then move toward the home (or index) position for that type of positioner. Homing will work whether the NSC200 is in Local or Remote mode.

NOTE

Homing is a critical process and can take several minutes until completion with some motion devices. As the NSC200 stores the current position into memory after every motion, there is no need to re-home a system under normal operation, even not after power-off.

Scanning of switchbox channels. If an NSC200 is connected to a switchbox, it must first learn which switchbox channels are connected and store this information in non-volatile EEPROM. Simultaneously press down the **V** and **P** buttons for 2 seconds, and the controller will scan all eight channel positions. The 8 LEDs of the switchbox will light up in sequence. Following the scan, the LED for each connected channel will be yellow. The LED for the selected channel will be green if there is no problem or red if there is an error or problem, such as the a positioner at its limit of travel. Scanning will work whether the NSC200 is in Local or Remote mode.

Selection of switchbox channel. Following the scan, toggle the NSC200 to Local mode. Press the **V** (left button) to decrement the channel or **P** (right button) to increment the channel. The LED associated with the selected switchbox channel will turn green (no problem) or red (error or problem encountered).

Motion control in Velocity mode. Once the NSC200 is in Local and Velocity modes, simply turn the control knob in the forward or reverse direction, and let go to stop motion. There are seven (8) jog speed settings for each direction. As the knob is turned further in either direction, the jog velocity will increase for that direction. The knob is spring loaded, and the resting position corresponds to zero speed. The 8 jog speed settings are part of the default setting for each type of positioner, but can be modified using the **SV** ASCII command.

Motion control in Position mode. Once the NSC200 is in Local and Position modes, turn the control knob to its extreme forward or reverse position. The controller will then move the positioner up or down by a preset number of micro-steps. To preset the number of micro-step, connect the NSC200 to a computer and issue an **SP** command followed by an **SM** command. To enable a feature where holding the knob in its extreme position will cause repositioning at regular intervals, execute an **SH** command with bit #2 set to 1, followed by an **SM** command.

Resetting RS485 bus address. Use a small diameter rod to press the reset button on the back of the controller. This will reset the RS485 bus address of the controller to its factory default setting of zero (0) so that the controller can be recognized as unitialized by *NewStep-Util* software. Once a desired RS485 bus address has been entered, the controller can then be digitally addressed in Remote mode using either *NewStep-Util* software or ASCII commands.

4.3 Reading the LED Status Lights

4.3.1 LED Indicator on NSC200 Controller

A tri-color LED adjacent to the control knob indicates the controller operating mode and operating conditions:

LED Status	Yellow	Green	Red
Solid	Remote mode, not in motion	Local mode, not in motion	Error condition
Blinking	Remote mode, in motion	Local mode, in motion	Firmware download

4.3.2 LED Indicators on NSC-SB Switchbox

A bank of eight tri-color LEDs on the front panel of the switchbox indicates the status of each channel:

LED Status	Green	Red	Yellow	Off
Connected & selected	Solid			
Disconnected & selected		Solid		
Connected & unselected			Solid	
Disconnected & unselected				Off

5 NewStep-Util Software

5.1 Overview

Newport's NewStep Utility program, *NewStep-Util*, provides computer access to the most commonly used NSC200 controller functions, including changing controller configuration, monitoring status, and issuing move/jog commands. This program is distributed on CD ROM with NSC200 controller purchases.

Note that the version of *NewStep-Util* distributed with the NSC200 is not backward compatible with the version distributed with the predecessor NSC100. It is however possible to use NSC100's and NSC200's on the same RS485 network provided that their respective software is used.

5.2 RS232 Communications Setup

Cabling. For computer control, an NSC200 controller or NSC-SB switchbox is connected to the RS232 COM Port of the PC via an RS485-to-RS232 converter, Model NSC-485-232-I. Please refer to the previous manual section for hookup diagrams. The converter is normally secured directly to the computer, but a straight-through serial data cable with a male DB9 connector on one end and a female DB9 connector on the other end can also be used to connect the converter and PC.

COM Port Setup. 19200 bps, 8 data bits, no parity, 1 stop bit.

Handshake Protocol. Handshaking between the host computer and controller is automatically provided by *NewStep-Util* software.

5.3 Software Installation

The *NewStep-Util* program allows computer control of most features available in the NSC200 controller. It is designed to run on a Pentium-class PC with a minimum of 64 MB of RAM and Windows 98, 2000, NT or XP.

To install *NewStep-Util*, load the distribution CD and double-click on *setup.exe*. The program will give you the option of where to load the files, or you can use the default directory *C:\Program Files\NewStep Controller*.

After installation is complete, reboot your PC and open *NewStep-Util* by double-clicking on the newly created icon (shown to right) in the *NewStep Controller* folder. The *Set Communication Port* window will open. Enter the *Port #* to which the controller is connected, such as *Com1*, then press the *Enter* button.

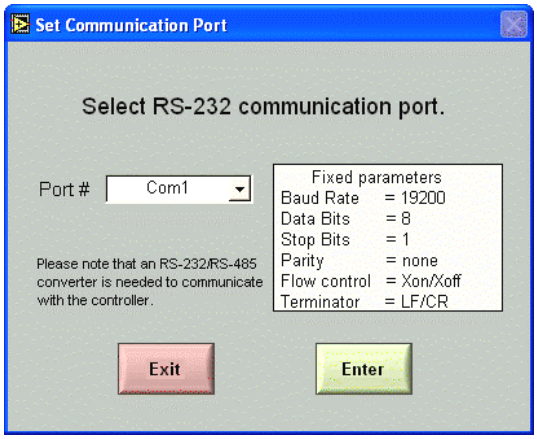


Figure 29: Set Communication Port Screen

5.4 Controller Initialization

Connect a controller to the specified port. If the program finds that the controller is uninitialized (controller address equal to zero as shipped from the factory), the *Initialize Controller* window (shown below) will open. Type the desired unique address (1-255) into the *Controller Address* field, or use the up or down arrows to increment or decrement, then press *OK*.

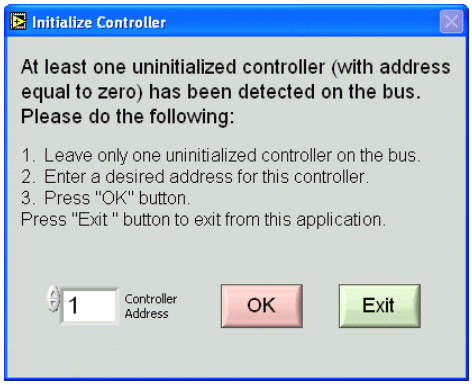

Initialize Controller
At least one uninitialized controller (with address equal to zero) has been detected on the bus.
Please do the following:
1. Leave only one uninitialized controller on the bus.
2. Enter a desired address for this controller.
3. Press "OK" button.
Press "Exit " button to exit from this application.
1
Controller Address
OK
Exit

Figure 30: Initialize Controller Screen

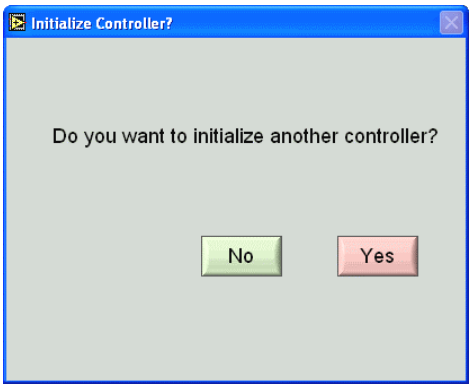


Figure 31: Initializing Another Controller Screen

After initializing each controller, the *Initialize Controller?* screen will open, asking if you want to initialize another controller. If you do, plug in the next uninitialized controller and press the *YES* button. The *Initialize Controller* window will open again, allowing you to enter an address for that controller. Note that only one uninitialized controller may be connected to the network at a time for initializing.

5.5 Network Scan

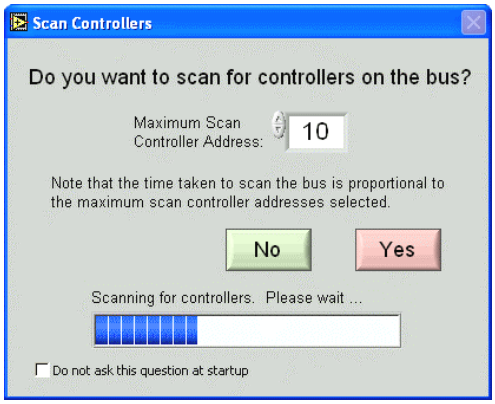

Scan Controllers
Do you want to scan for controllers on the bus?
Maximum Scan Controller Address:
10
Note that the time taken to scan the bus is proportional to the maximum scan controller addresses selected.
No
Yes
Scanning for controllers. Please wait ...
Do not ask this question at startup

Figure 32: Set Communication Port Screen

After all controllers have been initialized, the *Scan Controller* window (shown above) will open. Enter the maximum address to scan for, then press the *Yes* button. The *NewStep-Util* software will then scan the bus, find any controllers, and find any switchboxes connected to them. It will also discover and identify any positioners.

Note that while the highest possible address is 255, the time to scan the bus is proportional to the actual number of addresses to be scanned. If the check box at the bottom left of the screen is checked, the program will not scan the bus the next time the program is started.

Channel Description	Position	Units	Controller #	Channel #
NSA12	0	micro-steps	1	1
NSA12	0	micro-steps	1	2
NSA12	0	micro-steps	1	3

Figure 33: View all Screen

The *Main Screen* will open following the scan. Click on the *View All* tab. The resulting screen will show at a glance which controller #'s are on the bus and which have an associated switchbox with channel #'s. In case of a controller with no switchbox, the channel # is always 1. In case of a controller with a switchbox, the channel # may be from 1 to 8. Also shown is the type of positioner associated with each controller # and channel # (NSA12 or MFA-PP). The system will associate default values with each type of positioner.

5.6 Working with the Main Screen

The Main Screen, which appears after the bus has been scanned, is the main working screen of *NewStep-Util* software.

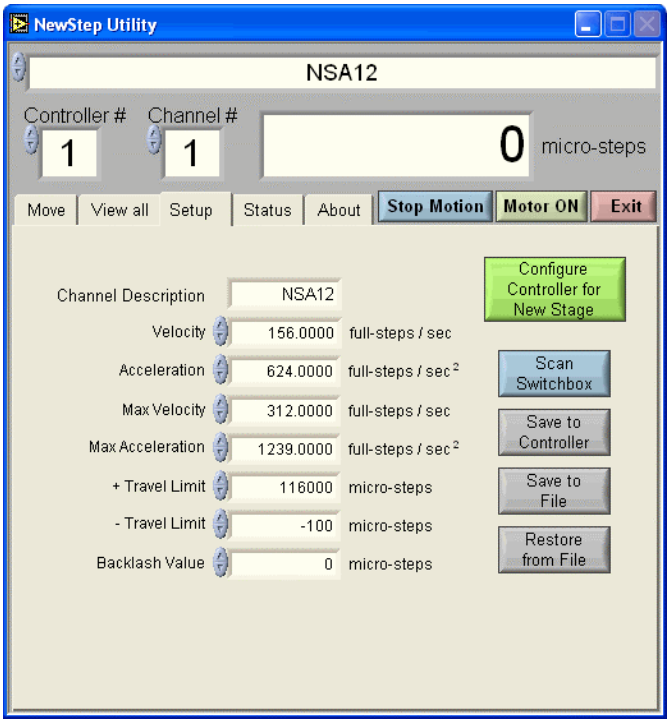


Figure 34: Setup Screen

Navigation through the screen is by means of five tabs (*Move*, *View all*, *Setup*, *Status*, *About*). With all five tabs, the top 25% of the screen remains the same, as follows:

The headline at the top shows the name of the channel (*NSA12* in this example), as assigned by the user for this axis in *Axis Description* under the *Setup* tab. Different channels can be selected by name with up and down arrow keys.

The *Controller* # field shows the bus address of the controller. You can select a different controller by typing in a different number or by stepping through the scanned controllers using and down arrow keys.

The Channel # field shows the channel number associated with the controller to the left. When a switchbox is used, you can select a different channel by typing in a different number of by stepping through the scanned channels using up and down arrow keys.

The *micro-steps* field shows the current location of the positioner in micro-steps.

The five tabs (*Move*, *View all*, *Setup*, *Status*, *About*) bring up five sub-screens, which will be explained below. The *Stop Motion* button steps motion for that channel. The *Motor ON* button turns on the motor for that channel. The *Exit* button exits *NewStep-Util*.

NOTE

Only one NSC200 controller can be communicated with at any given time by *NewStep-Util* software. Control as well as the *Stop Motion* and *Motor ON* buttons apply only to the selected controller and controller channel.

5.6.1 Setup Tab

The *Setup* tab brings up eight data fields, which apply only to the selected controller channel.

There are five buttons:

1. *Configure Controller for New Stage*. Press if the positioner is other than an NSA12. This will cause different default values to be loaded.

2. *Scan Switchbox*. Press if you have added or disconnected a positioner. This will initiate a new bus scan, followed by an updated *View all* tab screen.
3. *Save to Controller*. Press to enter any setup changes into the controller, where they will be saved in non-volatile EEPROM.
4. *Save to File*. Press to save any setup changes as a computer file.
5. *Restore from File*. Press to load previously save file data into non-volatile EEPROM of the controller and update the computer screen.

There are also eight data fields:

1. *Channel Description* is a custom name that a user can assign to the selected channel. This can be eight printable ASCII character, no spaces. See **ID** command.
2. *Velocity* is the desired velocity of the channel in full-steps/sec. See **VA** command.
3. *Acceleration* is the desired acceleration of the channel in full-steps/sec^2. See **AC** command.
4. *Max Velocity* is the maximum allowed velocity of the channel in full-steps/sec. The software will assign a default value for the specified positioner type. See **VU** command.
5. *Max Acceleration* is the maximum allowed acceleration in full-steps/sec^2. The software will assign a default value for the specified positioner type. See **AU** command.
6. + *Travel Limit* is the positive software travel limit in micro-steps (1/64 of a full-step). See **SR** command.
7. - *Travel Limit* is the negative software travel limit in micro-steps. See **SL** command.
8. *Backlash Value* is a compensation value in micro-steps that the controller will add for each direction change to compensate for mechanical backlash. See **BA** command.

5.6.2 Move Tab

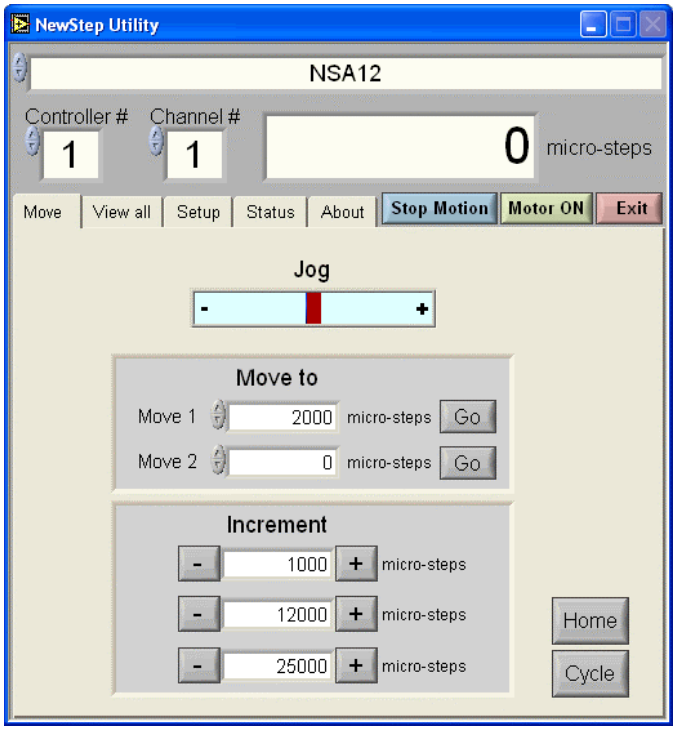


Figure 35: Move Screen

Pressing the *Move* tab brings up the above window with functions to move the positioner:

1. *Jog* is a bar with 8 positive and 8 negative positions, each of which corresponds to a speed setting. Press on any of the fields, and the positioner will move at the speed and direction set by that field. There is also a center position for zero speed.
2. *Move to* provides two white fields with absolute positions (*Move 1* and *Move 2*) in micro-steps. Type in desired positions or press the up or down

arrows to increment or decrement. Press the corresponding *Go* button, and the positioner will move to that position.

3. *Increment* provides three fields with relative positions in micro-steps. Press on the corresponding + or – buttons, and positioner will make that relative move in the positive or negative directions from its present position.

4. *Home* is a button which homes the positioner.

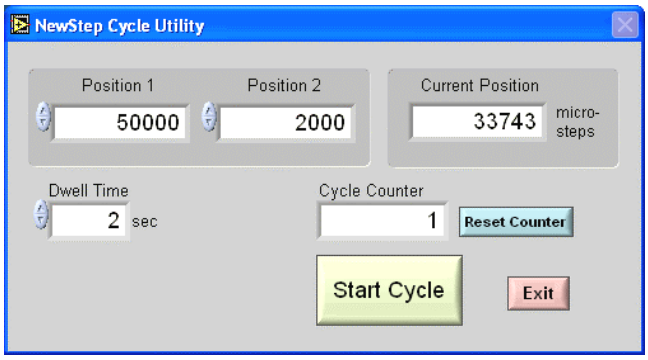


Figure 36: Cycle Utility Screen

NOTE

Homing is a critical process and can take several minutes until completion with some motion devices. As the NSC200 stores the current position into memory after every motion, there is no need to re-home a system under normal operation, even not after power-off.

5. *Cycle* is a button which opens the *NewStep Cycle Utility* window. Here you can specify two absolute positions (*Position 1* and *Position 2*) between which the actuator will move, as well as a *Dwell Time* in seconds between moves. Minimum dwell time is 1 second. Click on the *Start Cycle* button to initiate cycling. Click on the *Stop Cycling* button to stop cycling. Click on the *Exit* button to return to the main application.

5.6.3 Status Tab

Pressing the *Status* tab brings up a screen with 11 simulated LED indicators, which enable the user to view the hardware status of actual LEDs, limit switches, buttons, encoders, and voltage. A green simulated LED with an H indicates High, a white simulated LED with an L indicates Low. This same information is also returned by the **PH** *Get Hardware Status* command.

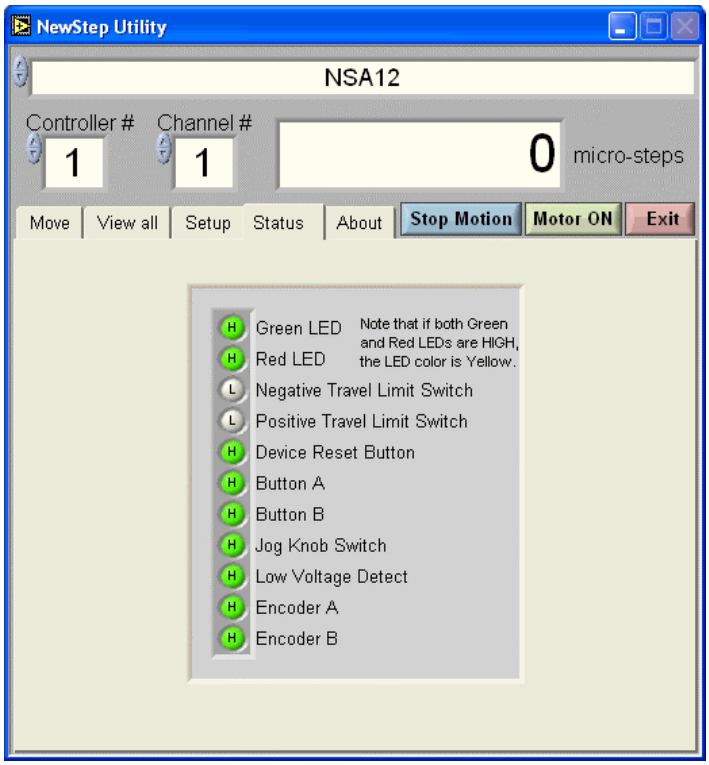


Figure 37: Status Screen

5.6.4 About Tab

Pressing the *About* tab brings up a screen which shows the current versions of *NewStep-Util* software and controller firmware as well as Newport contact information for technical support.

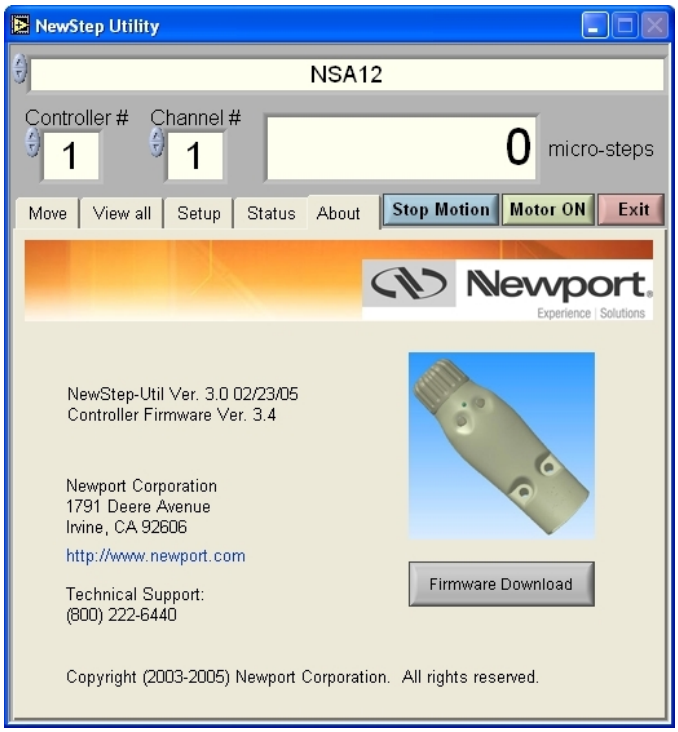


Figure 38: About Screen

6 NewStep ASCII Command Set

6.1 Command Set Introduction

This section describes the supported two-letter ASCII commands that may be used to configure and operate the NSC200 NewStep controller in Remote mode (Yellow LED), when the controller is connected to a computer either directly or via an NSC-SB switchbox. These commands work with LabView, Visual Basic, C++, or any other computer application that can issue ASCII commands via a computer COM port. Newport's *NewStep-Util* application, described in the previous section of this manual, utilizes these commands.

Note that the ASCII Command Set distributed with the NSC200 is not backward compatible with the set distributed with the predecessor NSC100. It is however possible to use NSC100's and NSC200's on the same RS485 network provided that their respective software is used.

6.1.1 LabView Support

Shipped with every NSC200 controller is a CD ROM with .llb drivers that are compatible with LabView versions 5.0 and above. These are building blocks for users who want to write their customer applications instead of using *NewStep-Util.*

6.1.2 Address Field

Since multiple NewStep controllers may be placed on the RS485 Bus or be connected to an NSC-SB Switchbox, each controller is assigned an address **xx** (or controller number) from 0 to 255. By decoding the address field of the incoming message, the controller can determine if the message is intended for it. This address **xx** needs to be prefix to each command. If the address does not match a specific controller, that controller ignores the message. If the address is missing, there is no error message, but the address is implied to be **0**. If the address is out of range, i.e., larger than 255, there is no error message, and no controller will respond.

6.1.3 Set or Query Commands

Commands are either Set or Query commands. A Set command changes a setup parameter or initiates an action. A Query command, which is always terminated by a question mark, reads back setup or status information. When the controller responds to a query, it first sends out the received command and then follows with the requested information. For example, if *234VE?* is sent to controller 234, it may respond with *234VE? 1.0*

6.1.4 Saving Settings to Non-Volatile Memory

When a setting is changed using a Set command, the new setting is written to RAM and is implemented immediately. When power is removed and reapplied, the change is lost unless the setting has been saved to non-volatile memory using the **SM** command. Always execute an **SM** command if you want changed parameters to be saved.

6.2 Command Set Summary

	Command Name	Short Description	Set Command	Query Command
1.	**AC**	Acceleration	√	√
2.	**AU**	Maximum Acceleration	√	√
3.	**BA**	Backlash Compensation	√	√
4.	**BX**	Scan Switchbox	√	√
5.	**BZ**	Restore EEPROM	√	-
6.	**DH**	Define Home	√	√
7.	**ID**	Positioner Identification	√	√
8.	**JA**	Jog	√	√
9.	**JS**	Jog Scale Factor	√	√
10.	**KM**	Knob Mode	√	√
11.	**MF**	Motor OFF	√	-
12.	**MO**	Motor ON	√	-
13.	**MX**	Select Switchbox Channel	√	√

14.	**OA**	Homing Acceleration	√	√
15.	**OH**	Homing Speed	√	√
16.	**OR**	Home	√	√
17.	**PA**	Absolute Position	√	√
18.	**PD**	Position Delay	√	√
19.	**PH**	Hardware Status	-	√
20.	**PR**	Relative Position	√	√
21.	**RS**	Reset	√	-
22.	**SA**	Controller Number	√	-
23.	**SH**	Set Hardware Configuration	√	√
24.	**SL**	Negative Software Limit	√	√
25.	**SM**	Save in Memory	√	-
26.	**SP**	Knob Position	√	√
27.	**SR**	Positive Software Limit	√	√
28.	**ST**	Stop Motion	√	-
29.	**SV**	Knob Velocities	√	√
30.	**TE**	Tell Error	-	√
31.	**TP**	Tell Position	-	√
32.	**TS**	Controller Status	-	√
33.	**VA**	Velocity	√	√
34.	**VE**	Firmware version	-	√
35.	**VU**	Maximum Velocity	√	√

Table 1 *Summary of Commands*

6.3 Command Set Details

AC Set Acceleration

Syntax	**xxACnn**	Sets acceleration value **nn** in full-steps/second^2 for controller **xx**. Execution is immediate. If motion is in progress, command is ignored and an error message is generated.
	xxAC?	Reports current acceleration value **nn** in full-steps/ second^2 for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Acceleration in full-steps/second^2 (floating number) to maximum value programmed with **AU** command.
Examples	**21AC12.5**	Sets acceleration value to 12.5 for controller 21.
	21AC?	Reads acceleration value from controller 21.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**AU**	Set maximum acceleration or deceleration.
	PA	Move to absolute position.
	PR	Move to relative position.
	VA	Set velocity.

AU Set Maximum Acceleration

Syntax	**xxAUnn**	Sets maximum acceleration value **nn** in full-steps/second^2 for controller **xx**. Execution is immediate. If motion is in progress, command is ignored and an error message is generated.
	xxAU?	Reports current maximum acceleration value.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Maximum acceleration value in full-steps/second^2 (floating number) from 0 to 500.
Examples	**21AU12.5**	Sets maximum acceleration value to 12.5 for controller 21.
	21AU?	Reads maximum acceleration value from controller 21.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 211. Maximum acceleration exceeded.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**AC**	Set acceleration or deceleration.
	PA	Move to absolute position.
	PR	Move to relative position.
	VA	Set velocity

BA Set Backlash Compensation

Syntax	**xxBAnn**	Sets backlash compensation value **nn** in micro-steps for controller **nn**. For each direction change, controller will add **nn** micro-steps to commanded position to compensate for mechanical backlash. There are 64 micro-steps per full-step. This command is effective only after an **OR** (home search) or **DH** (define home) has been executed. If motion is in progress, command is ignored and an error message is generated.
	xxBA?	Reports backlash compensation value for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Backlash compensation value (integer) in micro-steps from 0 to 512
Examples	**25BA128**	Sets backlash compensation value to 128 for controller 25.
	25BA?	Read backlash compensation value from controller 25.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**PA**	Move to absolute position.
	PR	Move to relative position.

BX Scan Switchbox

Syntax	**xxBX**	Causes controller **xx** connected to an NSC-SB switchbox to scan channels 1-8 and load a positioner table which indicates which channels are connected to a load. After the scan process, the selected positioner is the last found. If the last selected positioner was not found, the first connected positioner is selected. If no positioner is found, the selected positioner is set to 0.
	xxBX?	Reports which switchbox channels from 1-8 are connected to a load for controller **xx**. An **xxBX** command must have been executed previously.
Parameters	**xx**	Controller number (integer) from 0 to 255.
Examples	**25BX**	Initiates a positioner scan for controller 25.
	25BX?	Reports which switchbox channels of controller 25 are connected to a load. For example, the response 25BX 2,4,5 would indicate that channels 2, 4 and 5 are connected to a load.

BZ Restore EEPROM Content to Default

Syntax	**xxBZ**	Restores all non-volatile EEPROM factory default values for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
Example	**25BZ**	Restores factory default settings for controller 25.

DH Define Home Position

Syntax	**xxDHnn**	Defines home position value in micro-steps for controller **xx**. If motion is in progress, command is ignored and an error message is generated.
	xxDH?	Reads back home position value in micro-steps for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Defined home position value in micro-steps. Default value is 0. There are 64 micro-steps per full-step.
Examples	**21DH10**	Sets home position value to 10 for controller 21.
	21DH?	Reads back home position from controller 21.
Errors	**nn missing**	Error 38 Parameter missing.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**OA**	Set homing acceleration.
	OH	Set homing speed.
	OR	Search for home.

ID Set Positioner Identification

Syntax	**xxID nn**	Assigns a user-defined name to a positioner connected to controller **xx**. There needs to be a space after **ID**. If multiple positioners are connected to the controller via a switchbox, the positioner is selected via the **MX** command.
	xxID?	Reads back user-defined positioner name from controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	User-defined positioner name up to 8 ASCII characters long, such as *NSA12-1*.
Examples	**25IDNSA12**	Set positioner identification to *NSA12* for controller 25.
	25ID?	Reads back positioner identification from controller 25.

JA Start Jog Motion

Syntax	**xxJAnn**	Starts a jog motion with speed setting **nn** in full-steps/ second (fs/sec) for controller **xx**. If motion is in progress, command is ignored and an error message is generated.
	xxJA?	Reads back last jog speed setting from controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Jog setting from 0 to ±7 in full-steps/second (fs/sec). Note: for NSA12, 156.62 fs/sec = 1 mm/sec (max speed). **nn value** — **Jog Speed** 0 — 0 fs/s ±1 — ±0.07 fs/s ±2 — ±0.23 fs/s ±3 — ±0.78 fs/s ±4 — ±3.12 fs/s ±5 — ±15.62 fs/s ±6 — ±48.87 fs/s ±7 — ±156.62 fs/s
Examples	**25JA-5**	Starts jog motion at -15.62 fs/sec for controller 25.
	25JA?	Reads back value of last jog speed from controller 25.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Motor off	Error 213. Motor not enabled.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**MO**	Motor on.
	JS	Set Jos scale factor.
	ST	Stop motion.

JS Set Jog Scale-up Factor

Syntax	**xxJSAnn**	Sets jog scale-up factor **nn** for controller **xx**. This is a multiplier applied to all speed values set by the **JA** command. It is applied to computer commands, the control knob, and homing process. By default, it is set to 1 for the NSA12 and 6 for the MFA-PP. If motion is in progress, command is ignored and an error message is generated.
	xxJS?	Reports jog scale-up factor.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Jog scale-up factor (integer) from 0 to 255.
Examples	**25JS6**	Sets Jog scale-up factor to 6 for controller 25.
	25JS?	Reads back jog scale-up factor for controller 25.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**JA**	Start jog motion.

KM Knob Mode

Syntax	**xxKMnn**	Sets knob control mode **nn** to 0 for velocity mode or 1 for position mode for controller **xx**. If motion is in progress, command is ignored and an error message is generated.
	xxKM?	Reads back knob control mode for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Knob control mode. Choices are 0 for velocity mode or 1 for position mode.
Examples	**21KM0**	Sets knob control mode to velocity for controller 21.
	21KM?	Reads back knob control mode from controller 21.
Errors	**nn missing**	Error 38. Parameter missing.
	nn other than 0 or 1	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**SV**	Set velocities for knob control.
	SP	Set position distance for knob control.

MF Motor Off

Syntax	**xxMF**	Turns motor off for controller **xx**.
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**43MF**	Turns positioner motor off for controller 43.
Related Commands	**MO**	Motor on.

MO Motor On

Syntax	**xxMO**	Turns motor on for controller **xx**.
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**43MO**	Turns positioner motor on for controller 43.
Related Commands	**MF**	Motor off.
	JT	Stop motion.

MX Select Switchbox Channel

Syntax	**xxMX y**	Causes controller **xx** to command switchbox channel **y**. Upon execution, the controller loads settings from its non-volatile memory for channel **y**. If there is no switch-box or motion is in progress, command is ignored and an error message is generated.
	xxMX?	Reads back channel number **y**, as selected by the last MX command for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	y	Switchbox channel (integer) from 1 to 8.
Examples	**4MX 8**	Selects positioner connected to controller 4 and switch-box channel 8, and loads appropriate settings from its non-volatile memory.
	4MX?	Returns 4MX 8 for the above example, where 4 is the controller number and 8 is the switchbox channel.
Errors	**No switchbox in scan table**	Error 6. Invalid command.
	Positioner not in scan table	Error 214. Invalid axis.
	y other than 1-8	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**BX**	Scan Switchbox.
	SA	Controller Number.

OA Homing Acceleration

Syntax	**xxOAnn**	Sets homing acceleration to **nn** in full-steps/sec^2 for controller **xx**. If motion is in progress, command is ignored and an error message is generated.
	xxOA?	Reads back homing acceleration **nn** in full-steps/sec^2 for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Homing acceleration in full-steps/sec^2 (floating number) up to maximum acceleration specified by **AU** command. Default value is 624.00 (maximum acceleration for NSA12).
Examples	**21OA20.0**	Sets homing acceleration to 20.0 full-steps/sec^2 for controller 21.
	21OA?	Reads back homing acceleration in full-steps/sec^2 from controller 21.
Errors	**nn missing**	Error 38. Parameter missing.
	nn exceeds limit set by AU	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**DH**	Set home position
	OH	Set homing speed.
	OR	Search for home.

NOTE

Homing is a critical process and can take several minutes until completion with some motion devices.

OH Homing Speed

Syntax	**xxOHnn**	Sets homing speed **nn** in full-steps/sec (fs/sec) for controller **xx**. If motion is in progress, command is ignored and an error message is generated.
	xxOH?	Reads back homing speed **nn** in full-steps/sec for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Homing speed in full-steps/sec (floating number) up to maximum speed specified by **VU** command. Default value is156.00 (maximum speed for NSA12).
Examples	**21OH125.0**	Sets homing speed to 125.0 fs/sec for controller 21.
	21OA?	Reads back homing speed in fs/sec from controller 21.
Errors	**nn missing**	Error 38. Parameter missing.
	nn exceeds limit set by VU	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**DH**	Set home position
	OA	Set homing acceleration.
	OR	Search for home.

NOTE

Homing is a critical process and can take several minutes until completion with some motion devices.

OR Search for Home

Syntax	**xxOR**	Starts process of homing positioner to its negative hard limit. Once positioner is homed, position is set to zero. If motion is in progress, command is ignored and an error message is generated.
	xxOR?	Returns **1** if positioner has been homed or **0** if it has not been homed since last power up.
Parameters	**xx**	Controller number (integer) from 0 to 255.
Examples	**35OR**	Homes the positioner connected to controller 35.
	35OR?	Returns a **1** or **0** depending on whether controller 35 has been homed or not.
Errors	**Motor off**	Error 213. Motor not enabled.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**DH**	Define home.
	OA	Homing acceleration.
	OH	Homing speed.
	ST	Stop motion.

NOTE

Homing is a critical process and can take several minutes until completion with some motion devices. As the NSC200 stores the current position into memory after every motion, there is no need to re-home a system under normal operation, even not after power-off.

PA Move to Absolute Position

Syntax	**xxPAnn**	Initiates a move to absolute position **nn** in micro-steps for controller **xx**. When command is received, positioner executes a trapezoidal trajectory with a predefined acceleration, dwell speed, and deceleration. If motion is in progress, command is not accepted and an error message is generated.
	xxPA?	Reports last commanded absolute position in micro-steps for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Absolute position (integer) from -60000 to 120000 in micro-steps. There are 64 micro-steps per full-step.
Examples	**25PA1000**	Initiates motion to position 1000 for positioner connected to controller 25.
	25PA?	Reads back last commanded absolute position for controller 25.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Motor off	Error 213. Motor not enabled.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**AC**	Set acceleration.
	BA	Backlash compensation.
	PR	Move to relative position.
	ST	Stop motion.
	VA	Set velocity.

PD Position Delay in Knob Control

Syntax	**xxPDnn**	Sets delay between moves to **nn** milliseconds for controller **xx**.
	xxPD?	Reads delay value **nn** in milliseconds for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Delay value between moves in milliseconds. Default value is 100 ms.
Examples	**21PD50**	Sets delay between moves to 50 ms for controller 21.
	21PD?	Reads delay setting in milliseconds from controller 21.
	nn missing	Error 38. Parameter missing.
Related Commands	**KM**	Set knob mode
	SV	Set velocities for knob control.
	SP	Set position distance for knob control.

PH Get Hardware Status

Syntax	**xxPH?**	Returns 24 status bits (3 bytes) from controller. These are reported as a decimal number, which needs to be converted to binary. **Bit#** — **Status for bit value 1** (status is opposite for bit value 0) **0** Green LED on **1** Red LED on **2-7** N/A **8** Negative travel limit reached **9** Positive travel limit reached **10** N/A **11** Device reset button not pressed **12** Button A not pressed **13** Button B not pressed **14** Jog knob switch not pressed **15** Low voltage not detected **16** Encoder A signal high **17** Encoder B signal high **19** Driver enabled **20-23** N/A
Parameters	**xx**	Controller number (integer) from 0 to 255.
Example	**14PH?**	Returns 24 status bits from controller 14 as a decimal number, such as 147843. One way to convert this to binary is to use the Windows scientific calculator. Click on *Start* > *Programs* > *Accessories* > *Calculator* > *View* > *Scientific* > *Dec* (decimal). Copy and paste in the decimal number, then click on *Bin* (binary) to display the binary equivalent. The binary bits 0-24 are read from right to left.

PR Move to Relative Position

Syntax	**xxPRnn**	Initiates a move to relative position **nn** in micro-steps for controller **xx**. When command is received, positioner executes a trapezoidal trajectory with a predefined acceleration, dwell speed, and deceleration. If motion is in progress, command is not accepted and an error message is generated.
	xxPR?	Reports last commanded relative position in micro-steps for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Relative position (integer) from -60000 to 120000 in micro-steps. There are 64 micro-steps per full-step.
Examples	**25PR1000**	Initiates relative move of 1000 micro-steps for positioner connected to controller 25.
	25PR?	Reads back last commanded relative position for controller 25.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Motor off	Error 213. Motor not enabled.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**AC**	Set acceleration.
	BA	Backlash compensation.
	PA	Move to absolute position.
	ST	Stop motion.
	VA	Set velocity.

RS Reset Controller

Syntax	**xxRS**	Soft-resets processor in controller **xx**.
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**31RS**	Soft-resets controller 31.

SA Set Controller Address

Syntax	**xxSAnn**	Changes current controller address **xx** to new address **nn**.
Parameters	**xx**	Current controller address (integer) from 0 to 255.
	nn	New controller address (integer) from 0 to 255.
Example	**0SA14**	Changes controller address from 0 to 14.
Errors	**nn missing**	No error message returned. **nn** is set to 0.
	nn out of range	Error 7. Parameter out of range.

SH Set Hardware Configuration

<table>
<tr><td>Syntax</td><td>xxSHnn</td><td>Sets eight binary bits to specify the hardware configuration of the positioner connected to controller xx. nn is entered as a decimal number, which is automatically converted to binary by the controller. The factory default value of nn is decimal zero, which sets all eight bits to zero.</td></tr>
<tr><td></td><td>xxSH?</td><td>Reads back eight hardware configuration bits nn for positioner connected to controller xx. The data is returned as a decimal number, to be converted to binary by the user.</td></tr>
<tr><td>Parameters</td><td>xx</td><td>Controller number (integer) from 0 to 255.</td></tr>
<tr><td></td><td>nn</td><td>
<table>
<tr><th>Bit#</th><th>Val.</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>Enable hardware limit checking.</td></tr>
<tr><td></td><td>1</td><td>Disable hardware limit checking.</td></tr>
<tr><td>1</td><td>0</td><td>Reserved. Always set to zero.</td></tr>
<tr><td>2</td><td>0</td><td>Do not command a new relative move if in position mode and knob is turned all the way.</td></tr>
<tr><td></td><td>1</td><td>Command a new relative move if in position mode and knob is turned all the way.</td></tr>
<tr><td>3</td><td>0</td><td>Enable local access to switching between velocity and position modes.</td></tr>
<tr><td></td><td>1</td><td>Disable local access to switching between velocity and position modes.</td></tr>
<tr><td>4</td><td>0</td><td>Clockwise turn results in positive motion.</td></tr>
<tr><td></td><td>1</td><td>Clockwise turn results in negative motion.</td></tr>
<tr><td>5</td><td>0</td><td>Enable local switchbox scan.</td></tr>
<tr><td></td><td>1</td><td>Disable local switchbox scan.</td></tr>
<tr><td>6</td><td>0</td><td>Enable home search process (local/remote)</td></tr>
<tr><td></td><td>1</td><td>Disable home search process (local/remote)</td></tr>
<tr><td>7</td><td>0</td><td>Enable software travel limit checking.</td></tr>
<tr><td></td><td>1</td><td>Disable software travel limit checking.</td></tr>
</table>
</td></tr>
</table>

Examples	**12SH00**	Enables hardware limit checking, etc., for controller 12. One way to convert the desired binary number to decimal is to use the Windows scientific calculator. Click on *Start* > *Programs* > *Accessories* > *Calculator* > *View* > *Scientific* > *Bin* (binary). Enter the desired binary number, then click on *Dec* (decimal) to display the decimal number to be entered as **nn**. The binary bits 0-7 are read from right to left.
	12SH?	Reads back hardware configuration from controller 12.
Errors	**nn missing**	No error message. **nn** and all bit values are set to 0.
	nn out of range	No error message. Controller only looks at first 8 bits following conversion to binary.

SL Set Left Travel Limit

Syntax	**xxSLnn**	Sets value of negative software limit, or extreme left allowed range of travel. This value should be less than the positive software limit. If motion is in progress, command is not accepted and an error message is generated.
	xxSL?	Reports value of negative (left) software limit.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Negative software limit (integer) from -60000 to 120000 micro-steps. There are 64 micro-steps per full-step.
Examples	**72SL-100**	Sets negative software limit to -100 for controller 72.
	72SL?	Reads back negative software limit from controller 72.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**JA**	Jog.
	PA	Move to absolute position.
	PR	Move to relative position.
	SR	Positive software limit.

SM Save Settings to Non-Volatile Memory

Syntax	**xxSM**	Saves controller configuration settings from RAM to non-volatile EEPROM memory. This command should be issued after modifying settings so that these are not lost when controller is powered off.
Parameters	**xx**	Controller number (integer) from 0 to 255.
Examples	**61SM**	Saves changes for controller 61 to non-volatile memory.
Related commands	**AC, AU, SL, SR, VA, VU, etc…**	All commands that change a setting.

SP Set Position for Knob Control

Syntax	**xxSPnn**	Sets an absolute or relative distance **nn** in micro-steps that will be commanded by controller **xx** when knob control is configured for position mode and knob is at its extreme position. The sign (positive or negative) of this distance will be the same as for the knob rotation. If motion is in progress, command is not accepted and an error message is generated.
	xxSP?	Reads back knob control distance for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Knob control distance in micro-steps. Default value is 2765. There are 64 micro-steps per full-step.
Examples	**12SP1000**	Sets knob control distance to 1000 micro-steps for controller 12.
	12SV?	Reads back knob control distance from controller 12.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**PD**	Position delay.
	KM	Set knob mode to velocity or position.
	SH	Set hardware configuration.

SR Set Right Travel Limit

Syntax	**xxSRnn**	Sets value of positive software limit, or extreme right range of travel. This value should be larger than negative software limit. If motion is in progress, command is not accepted and an error message is generated.
	xxSR?	Reports value of positive (right) software limit.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Positive software limit (integer) from -60000 to 120000 micro-steps. There are 64 micro-steps per full-step.
Examples	**72SR3000**	Sets positive software limit to 3000 for controller 72.
	72SR?	Read back positive software limit from controller 72.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**JA**	Jog.
	PA	Move to absolute position.
	PR	Move to relative position.
	SR	Positive software limit.

ST Stop Motion

Syntax	**xxST**	Stops motion in progress using deceleration rate programmed with **AC** (set deceleration) command for controller **xx**.
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**41ST**	Stops positioner motion for controller 43.
Related Commands	**MO**	Motor on.
	AC	Set acceleration.

SV Set Velocities For Knob Control

Syntax	**xxSVn1,n2,n3, n4,n5,n6,n7,n8**	Defines eight (8) velocity settings in full-steps/sec that controller **xx** will use when knob control is configured for velocity mode. A space is optional after each comma.
	xxSV?	Reads back knob velocity settings for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	n1,n2,n3,n4,n5 n6,n7,n8	Eight numbers (floating point) for velocity settings 1-8 in full-steps/sec. Default settings (selected for NSA12) are the following: n1 0.00 n2 0.07 n3 0.23 n4 0.78 n5 3.12 n6 15.62 n7 46.87 n8 156.62
Examples	**12SV0.00,0.07, 0.23,0.78,3.12, 15.62,46.87,156.62**	Sets eight knob velocity settings for controller 12. The values shown are the above default values.
	12SV?	Reads back eight knob velocity settings from controller 12.
	n1-n8 missing	No error message. All missing values are set to 0.
Related Commands	**KM**	Set knob mode to velocity or position.

TE Read Error Code

Syntax	**xxTEnn?**	Reads error code from controller **xx**. **Description** — **Error Code** No errors — 0 Invalid command — 6 Parameter Out of Range — 7 No Motor connected — 8 Brown-out — 10 Command parameter missing — 38 Positive hardware limit detected — 24 Negative hardware limit detected — 25 Positive software limit detected — 26 Negative software limit detected — 27 Max velocity exceeded — 210 Max acceleration exceeded — 211 Motor not enabled — 213 Switch to invalid axis — 214 Homing aborted — 220 Parameter change not allowed during motion — 226
Parameters	**xx**	Controller number (integer) from 0 to 255.
Example	**23TE?**	Returns error code from controller 43.

TP Read Position

Syntax	**xxTPnn?**	Returns position in micro-steps of positioner connected controller **xx** and switchbox channel **nn**. The controller operates in "open loop" fashion and returns a calculated value of position. This may be the calculated position during a very slow motion, or the latest executed commanded position. There are 64 micro-steps per full-step.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Channel 1-8 of a switchbox connected to controller **xx**, if applicable. This term is not needed if there is no switchbox. If **nn** is omitted, the position is returned for the latest channel associated with controller **xx**.
Examples	**25TP3?**	Returns position value of positioner connected to switchbox channel 3 of controller 25.
	25TP?	Returns position value of positioner associated with controller 25.
Related Commands	**JA**	Jog.
	PA	Move to absolute position.
	PR	Move to relative position.

TS Controller Status

Syntax	**xxTS?**	Returns a status number for controller **xx**: Motor on, motion not in progress 81 Motor on, motion in progress 80 Motor off, motion not in progress 64
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**25TS?**	Returns status number for controller 25.
Related Commands	**MF**	Motor off.
	MO	Motor on.
	TE	Tell error.
	TP	Tell position.

VA Set Velocity

Syntax	**xxVAnn**	Sets velocity value in full-steps/sec (fs/sec) for controller **xx**. If motion is in progress, command is not accepted. If motion is in progress, command is ignored and an error message is generated.
	xxVA?	Reports velocity value in full-steps/sec for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	0 to maximum value (floating point) in full-steps/sec up to the maximum programmed with **VU** command. For example, to set the velocity of an NSA12 actuator to 0.5 mm sec, you would need to program **nn** to 0.5 mm/sec x 1 full-step/6.4 µm = 78.1 full-steps/sec.
Examples	**17VA26.6**	Sets velocity of controller 17 to 26.6 full-steps/sec.
	17VA?	Reads back velocity in full-steps/sec from controller 17.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 210. Maximum velocity exceeded.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**AC**	Set acceleration.
	AU	Set maximum acceleration.
	VU	Set maximum velocity.

VE Read Controller Firmware Version

Syntax	**xxVE?**	Returns firmware version in *Major.Minor_NSC200* format.
Parameter	**xx**	Controller number (integer) from 0 to 255.
Example	**38VE?**	Returns firmware version of controller 38, such as *3.4_NSC200*, where *3* is the major and *4* is the minor firmware revision.

VU Set Maximum Velocity

Syntax	**xxVUnn**	Sets maximum value of velocity in full-steps/sec (fs/sec) for controller **xx**. If motion is in progress, command is not accepted and an error message is generated.
	xxVU?	Reports maximum value of velocity in full-steps/sec (fs/sec) for controller **xx**.
Parameters	**xx**	Controller number (integer) from 0 to 255.
	nn	Maximum value (floating point) of velocity in full-steps/sec.
Examples	**17VU156.2**	Sets maximum velocity of controller 17 to 156.2 full-steps/sec. This example is the maximum speed of the NSA12: 1 mm/sec x 1 full-step/6.4 µm = 156.2 full-steps/sec.
	17VA?	Reads back maximum velocity in full-steps/sec from controller 17.
Errors	**nn missing**	Error 38. Parameter missing.
	nn out of range	Error 7. Parameter out of range.
	Command during motion	Error 226. Command not allowed during motion.
Related Commands	**VA**	Set velocity.
	AC	Set acceleration.
	AU	Set maximum acceleration.

7 Maintenance & Service

CAUTION

There are no user serviceable parts inside NewStep components. Work performed by persons not authorized by Newport Corporation will void the warranty.

7.1 Enclosure Cleaning

The NewStep Actuator and Motion Controller should only be cleaned with a soapy water solution. Do not use an acetone or alcohol solution, as this will damage the finish of the enclosure.

7.2 Technical Support

This section contains information regarding factory service for NewStep Actuators and Controllers. The user should not attempt any maintenance or service of the equipment. Any problem that cannot be resolved should be referred to Newport Corporation.

Telephone	1-800-222-6440
Fax	1-949-253-1479
Address	Newport Corporation Service Department 1791 Deere Ave., Irvine, CA 92606
Email	tech@newport.com or istd.service@newport.com
Web Page URL	http://www.newport.com/Support/Technical_Help/ http://www.newport.com/Support/Service_and_Returns/

Contact Newport to obtain information about factory service. Telephone contacts number(s) are provided on a Service Form. Please have the following information available:

- Equipment model number (NSC200, NSA1, MFA-PP, NSC-SB).
- Equipment Serial Number
- Problem Description (document this by using the Service Form)

If the instrument is to be returned for repair, the user will be given a Return Authorization Number that needs to be referenced in their shipping documentation. Complete a copy of the Service Form shown below and fax it to Newport at the number indicated.

7.3 Service Form

Newport
Experience | Solutions

Newport Corporation
USA Office: 800-222-6440
FAX: 949-253-1479

Name _____ **Return Authorization** _____
(Please obtain RA# prior to return of item)

Company _____
(Please obtain RA # prior to return of item)

Address _____ Date _____

Country _____ Phone Number _____

P.O. Number _____ FAX Number _____

Item(s) Being Returned:

Model # _____ Serial # _____

Description _____

Reason for return of goods (please list any specific problems):

Newport Corporation
Worldwide Headquarters

1791 Deere Avenue
Irvine, CA 92606

(In U.S.): 800-222-6440
Tel: 949-863-3144
Fax: 949-253-1680

Internet: www.newport.com
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